



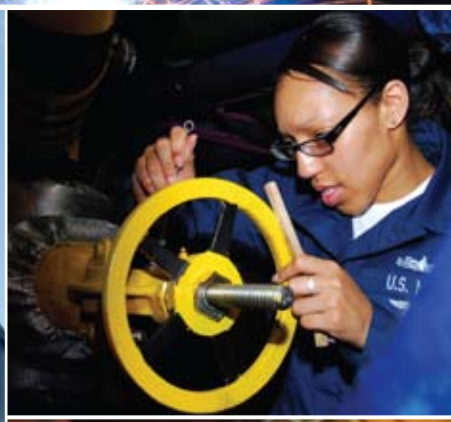

2010 PROJECT BOOK

Navy ManTech...bridging the affordability gap

NAVY MANTECH
Manufacturing Technology Program

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2010 Navy ManTech Project Book: This 2010 edition of the Navy ManTech Project Book provides brief write-ups for most of the Navy ManTech projects active in FY09. To highlight the Navy ManTech Program Investment Strategy with its concentration on a few key platforms, the projects are organized by platform or, where it makes sense, by organization. Please feel free to contact any of the Points of Contact listed in the project write-ups for additional information on any Navy ManTech project.

The Navy Manufacturing Technology (ManTech) Program provides for the development of enabling manufacturing technology and the transition of this technology for the production and sustainment of Navy weapon systems to support the Fleet. Navy ManTech is currently focused on shipbuilding affordability. Reducing the acquisition cost of current and future platforms is a critical goal of the Navy, and ManTech aids in achieving this goal by developing, maturing, and transitioning key manufacturing technologies.

Transition of technology is key to Navy ManTech's success. Advances in manufacturing technology are useful to the Navy only if they result in implementation in the production of weapon systems. Transition of manufacturing processes to private and government industrial entities that manufacture and repair systems and components for the Fleet is the goal of every ManTech project.

The Navy ManTech Program works with defense contractors, the Naval Research Enterprise, Navy acquisition Program Offices, and academia to develop improved processes and equipment. The Program is structured to provide maximum dissemination of the results of ManTech projects and to promote early implementation to strengthen the defense industrial base. With their expertise in specific technology areas, the Navy ManTech Centers of Excellence (COEs) play a key role in the definition and execution of the Navy ManTech Program. The customers of the Navy ManTech Program range from the acquisition Program Managers (PMs) and industry responsible for transitioning major Navy weapon systems from development into production, to the logistics managers at the naval depots and shipyards responsible for repair, overhaul, and remanufacture of major weapon systems. Additional beneficiaries of the Navy ManTech Program include the other Services and academia.

The Navy ManTech Program is managed by the Office of Transition within the Office of Naval Research (ONR), with direct oversight from the Chief of Naval Research. With the transition of technologies to the Fleet and acquisition as top priorities, ONR's Office of Transition is composed of transition-centric programs including ManTech, Future Naval Capabilities (FNCs), the Small Business Innovation Research (SBIR) / Small Business Technology Transfer (STTR), and other transition initiatives.

Department of Defense (DoD) oversight of the ManTech programs of the Services and the Defense Logistics Agency (DLA) is currently provided by the Directorate of Research of the Director, Defense Research and Engineering (DDR&E). The directors of the ManTech programs of the Army, Navy, Air Force, and DLA and the director of the Producibility and Manufacturing office of the Missile Defense Agency (MDA) coordinate their programs through the auspices of the Joint Defense Manufacturing Technology Panel (JDMTP) with representation including the Office of the Secretary of Defense (OSD), the Department of Commerce's National Institute of Standards and Technology (NIST), the Department of Energy, and industry. The JDMTP is organized to identify and integrate requirements, conduct joint program planning, and develop joint strategies.

The objective of the Navy ManTech Program is to significantly improve the affordability and improve mission capability of Department of the Navy (DoN) systems by engaging in manufacturing initiatives that address the entire weapon system life cycle and that enable the timely transition of technology to industry to support the Fleet.

More specifically, DOD Directive 4200.15 states that ManTech investments shall:

1. Aid in the economical and timely acquisition and sustainment of weapon systems and components.
2. Ensure that advanced manufacturing processes, techniques, and equipment are available for reducing DOD material acquisition, maintenance, and repair costs.
3. Advance the maturity of manufacturing processes to bridge the gap from research and development advances to full-scale production.
4. Promote capital investment and industrial innovation in new plants and equipment by reducing the cost and risk of advancing and applying new and improved manufacturing technology.
5. Ensure that manufacturing technologies used to produce DOD material are consistent with safety and environmental considerations and energy conservation objectives.
6. Provide for the dissemination of Program results throughout the industrial base.
7. Sustain and enhance the skills and capabilities of the manufacturing workforce, and promote high levels of worker education and training.
8. Meet other national defense needs with investments directed toward areas of greatest need and potential benefit.

Navy ManTech: Bridging the Affordability Gap by —

- Focusing resources on key, high-priority acquisition platforms
- Targeting cost reduction as the primary benefit
- Developing critical manufacturing and repair / sustainment solutions
- Engaging relevant industry partners up-front and throughout the process
- Targeting ManTech transition and platform implementation as the key measures of success

The Navy ManTech Program Investment Strategy concentrates ManTech investments on key Navy acquisition programs. The present emphasis is on addressing the critical Navy goal of reducing the acquisition cost of current and future platforms. Beginning in 2006, ManTech adopted a shipbuilding affordability investment strategy. Platforms for investment are determined by total acquisition funding; stage in acquisition cycle; platform cost reduction goals; cost reduction potential for manufacturing; and other factors primarily associated with the ability of ManTech to deliver the technology when needed. ManTech investments are currently focused on affordability improvements for four major acquisition platforms: DDG 1000, CVN 78 Class, the Littoral Combat Ship (LCS), and the VIRGINIA Class Submarine (VCS). ManTech is helping these four programs achieve their respective affordability goals by transitioning needed manufacturing technology which, when implemented, results in a cost reduction or cost avoidance (measured as $/hull) for these key platforms.

Strategic planning for Navy ManTech is an ongoing effort. Navy ManTech annually analyzes acquisition scenarios and plans to determine major acquisition programs for potential investment. As the current ManTech platforms mature through their acquisition cycles, ManTech's investment targets will change. Improving the affordability of Joint Strike Fighter (JSF) is one likely area for future investment.

Navy ManTech projects are developed in conjunction with industry and the acquisition Program Manager (PM). Planning for transition prior to the initiation of projects is critical for the implementation of technology on the factory floor and eventually into the Fleet. The Program Executive Offices (PEOs), PMs, and relevant industry partners are encouraged to participate in an initial concept exploration phase – an assessment of the manufacturing processing needs of the weapon system. Most importantly, this includes

the determination of whether the ManTech projects have a high likelihood of successful completion in time to meet the "window of opportunity" for insertion into the weapon system. Balanced with ManTech's available resources, highest priority manufacturing opportunities are selected.

Agreements are also reached on the degree of participation of the PEO/PM in support of the projects. The goal is for each PEO/PM to contribute resources to enable successful completion and implementation of the ManTech projects. Resources supplied may include financial support or cost share for the ManTech project itself or funding of Navy laboratory personnel to provide test, evaluation, certification, and/or other services. In addition, each PEO/PM is expected to provide personnel with technical expertise and/or management experience to assist the ManTech Program Office in project oversight. This support affords assurance that the weapon system PM is truly committed to the successful outcome of the ManTech project. In addition, this close working relationship between the parties provides ManTech with a longer-term view of implementation.

To clarify communication between program participants, Navy ManTech has established definitions for "transition" and "implementation" and has instituted the development of a Technology Transition Plan for each project that is signed by Navy ManTech, the COE Director, Industrial Facility Management, the Program Office and, if appropriate, the Technical Warrant Holder.

For Navy ManTech purposes:

- **Transition** denotes that point at which the ManTech project is completed and the technology meets customer (Program Office / industry) criteria / goals for implementation.
- **Implementation** denotes the actual use on the factory floor of ManTech results. (The resources for implementation are typically provided by entities other than ManTech including the Program Office and/or industry).

ManTech, alone, cannot ensure implementation, but a well-defined Technology Transition Plan assists the Program Office and Industrial Facility Management in supporting the transition and in resourcing and achieving implementation. In addition to increased involvement with the PM customer, ManTech engages key industry partners early in the development cycle and continues to keep industry involved throughout. Focused initiative integrated project teams (IPTs) keep communication lines open among the PM, Navy ManTech, the COEs, and industry to ensure that projects complete in time to meet the "window of opportunity" for implementation. Projects whose implementation opportunities have been lost are terminated. Thus the Navy ManTech Program ensures that resources are focused on those projects with high implementation probability.

Technology roadmaps have been developed for all four currently supported ship platforms. Components of current roadmaps include: (1) acquisition schedule – as identified in the Feb 2008 Navy Revised 30 Year Shipbuilding Report to Congress; (2) shipbuilding requirements – garnered from ship acquisition Program Offices, industry, and the National Shipbuilding Research Program (NSRP) Strategic Plan which identifies common shipyard process deficiencies; (3) Navy ManTech Focus Areas; and (4) Navy ManTech financials – funding and anticipated cost reduction. These roadmaps are shared with both the platform Program Offices and the relevant industry to ensure that Navy ManTech is investing in the highest priority areas for that particular platform.

To understand and assess progress towards meeting both platform and ManTech affordability goals, Navy ManTech has instituted an affordability assessment effort which identifies cost avoidance / savings per project, as well as estimated total savings per platform. An initial assessment was conducted in July of 2007 and updates have been made twice a year since then.

While the large majority of yearly ManTech Program resources are invested in accordance with the shipbuilding affordability investment strategy, Navy ManTech does support smaller efforts in Benchmarking and Best Practices, Energetics, and Repair Technology (REPTECH).

BENCHMARKING AND BEST PRACTICES: The Benchmarking and Best Practices Center of Excellence (B2PCOE) is a Navy and DOD resource for sharing best practice standards for mature manufacturing technologies, stable and producible designs, and mature production processes. The B2PCOE maintains strategic partnerships with academic organizations, industry, and government across all technology disciplines that impact Navy and DOD platforms and weapon systems. More information on the Navy ManTech's B2PCOE can be found on Page 8.

ENERGETICS: Energetics ManTech projects develop and transition process technologies for the synthesis of new or improved energetic materials, improved manufacture of propellants and explosives, and improved handling and loading of energetic materials into systems and components. Concentration is on developing solutions to ensure the availability of safe, affordable, and quality energetics products in support of Program Executive Offices such as Integrated Warfare Systems (PEO IWS/IWS3C) and Conventional Strike Weapons (PEO (W)/PMA 201). More information on Navy ManTech's Energetics Manufacturing Technology Center (EMTC) can be found on Page 11.

REPTECH: While the major emphasis of the Navy ManTech Program is on support of new production, ManTech also addresses repair, overhaul, and sustainment functions that emphasize remanufacturing processes and advancing technology. The REPTECH Program focuses on fielded weapon systems and provides the process and equipment technology needed for repair and sustainment. Requirements for REPTECH projects are driven by Navy depots, shipyards, Marine Corps Logistics Bases, intermediate maintenance activities, and contractor facilities responsible for overhaul and maintenance of fleet assets. In general, REPTECH projects are usually shorter in duration and are funded at lower levels than standard ManTech projects. The REPTECH Program is run by the Institute for Manufacturing and Sustainment Technologies (iMAST). More information can be found on Page 12.

The Navy ManTech Program executes its projects primarily through its COEs. The COEs were established as focal points for the development and transition of new manufacturing processes and equipment in a cooperative environment with industry, academia, and the Naval Research Enterprise.

The COEs:

- Execute projects and manage project teams
- Serve as corporate expertise in technological areas
- Collaborate with acquisition program offices / industry to identify and resolve manufacturing issues
- Develop and demonstrate manufacturing technology solutions for identified Navy requirements
- Provide consulting services to naval industrial activities and industry
- Facilitate transfer of developed technologies

Descriptions of ManTech's nine COEs are presented below.

Benchmarking and Best Practices Center of Excellence

The Benchmarking and Best Practices Center of Excellence (B2PCOE) mission is to identify, validate, and disseminate best in-class practices, processes, methodologies, systems, and best practice technologies with the end objective of improving the level of competitiveness of the defense industrial base and the affordability and performance of defense platforms and weapon systems. The B2PCOE vision is to be a Navy and Department of Defense resource for sharing best practice standards for mature manufacturing technologies, stable and producible designs, and mature production processes.

Operated by the American Competitiveness Institute in Philadelphia, PA, the B2PCOE identifies, validates, and disseminates best in-class practices, processes, methodologies, systems, and best practice technologies with the end objective of improving the level of competitiveness of the defense industrial base and the affordability and performance of defense platforms and weapon systems. As a Navy and DOD resource for sharing best practice standards for mature manufacturing technologies, stable and producible designs, and mature production processes, the B2PCOE maintains strategic partnerships with academic organizations, industry, and government across all technology disciplines that impact Navy and DOD platforms and weapon systems. The three focus areas within the B2PCOE are: (1) Energy Savings, (2) Advanced Technology Affordability, and (3) Open Architecture.

The focus of the Energy Savings thrust is the overall reduction in energy usage and the subsequent cost savings for Navy shipyards. The B2PCOE will systematically benchmark energy consumption by maximum use and establish the recommend best practices that will result in the greatest cost reduction. The objective will be achieved by identifying current best practices and equipment available now to reduce the current energy demand as well as facilitate larger-scale improvements in manufacturing techniques, tooling modernization, and alternate sources of energy.

The objective of Advanced Technology Affordability activity is to identify high priority, emerging technologies that have a high probability of reducing the acquisition cost of future submarines and surface ships. Benchmarking manufacturing technologies enabling improved process efficiencies or product performance would have a direct benefit on the affordability of future submarine and surface ship platforms. Many of these technologies of interest fall outside of the traditional shipbuilding industry or industries that develop integrated warfare systems. The approach is to benchmark and roadmap future manufacturing technologies that address high priority targets as they relate to ship design / construction and combat system integration.

In order to support the Navy's strategy in open architecture, the B2PCOE established a Benchmarking Activity to collect best practices and develop recommendations as they relate to the integration of open architecture designs in current and future Navy systems in an attempt to improve its use and to improve the acquisition affordability of high cost, ship-based combat systems and their associated life-cycle cost. Recommendations on activities within the applied S&T community that support the implementation of open architecture concepts and designs will be generated. A baseline review and lessons learned of the acquisition experience associated with high cost systems in terms of implementing open architecture will be accomplished at the onset of this effort. After the initial baseline is developed, companies in the commercial and defense aviation and shipbuilding markets will be benchmarked to establish best practices that could be shared to support an increased use of open architecture designs.

B2PCOE Web site: www.dodb2pcoe.org

Center for Naval Shipbuilding Technology

The mission of the Center for Naval Shipbuilding Technology (CNST) is to identify, develop, and deploy in U.S. shipyards, advanced manufacturing technologies that will reduce the cost and time to build and repair Navy ships. The Center works closely with the Navy's acquisition community and the shipbuilding industry to identify manufacturing technology issues that negatively impact shipyard efficiency, both with respect to cost and cycle time. CNST solicits, selects, and funds projects to address these critical and costly issues. The projects are focused on improving major ship construction and repair processes, such as optimizing production processes, predicting and reducing weld distortion, developing more efficient structural fabrication product lines, increasing the use of robotic welding methods, and eliminating inefficiencies in training, material usage, and supply chain procedures.

Operated and managed by Advanced Technology Institute (ATI) in Charleston, SC, CNST is pursuing projects focused on improving the affordability of current Navy acquisition programs, specifically VIRGINIA Class submarines, Ford-Class aircraft carriers, Zumwalt-Class destroyers, and the Littoral Combat Ship. New projects being considered include investigating the use of adhesives for mounting lightweight outfitting items, developing smart manufacturing methods for composite structures, implementing a mobile hybrid laser welding system, installing state-of-the-art hull accuracy control tools, improving shipyard-wide parts marshalling, and improving outfitting practices.

CNST Web site: http://www.cnst.us

Composites Manufacturing Technology Center

The Composites Manufacturing Technology Center (CMTC), established in 2000, is located in Anderson, SC, and is operated by the South Carolina Research Authority (SCRA). The CMTC is consortium-based with a balanced membership providing expertise to address all Navy composites manufacturing technology needs. The Composites Consortium (TCC) membership includes prime contractors, composites industry suppliers, and universities. TCC has strong, in-depth knowledge and experience in composites manufacturing technology for all modern DOD weapon systems. As part of CMTC's organizational structure, all laboratories, facilities, and project labor resources are provided by project teams assembled from consortium members. This unique structure results in cost benefit to the Navy, with maximum funding going to project execution. CMTC's current portfolio includes composites manufacturing projects for manned and unmanned aircraft, surface ships, submarines, missiles, and land vehicles.

CMTC Web site: http://cmtc.scra.org

Electro-Optics Center

The Penn State University Electro-Optics Center (EOC) was established in 1999 as the Navy's Center of Excellence for electro-optics. The center, located in Freeport, PA, utilizes two facilities with a total of 63,000 square feet of laboratory and office space. The vision of the EOC is to be the national resource for the advancement of electro-optics and related technology for the primary benefit of national security.

The mission of the EOC is to:

- Provide the best and latest electro-optic (E-O) technologies for the U.S. warfighter and national security interests
- Partner with government, industry, universities, and nonprofit organizations
- Conduct basic and applied research and technology demonstrations that add to the greater capabilities of the technology field through resident expertise and collaborations
- Seek out and facilitate technology transfer leading to the commercialization of E-O and related technologies
- Expand the current and prospective workforce through education and outreach
- Provide effective project and program management and knowledge of the government acquisition process

The EOC is supported by the Electro-Optics Alliance, a growing consortium of 400+ industrial, government, non-profit, and academic organizations that share their E-O expertise and capabilities through project teams focused on Navy and DOD requirements. The purpose of the Alliance is to advance DOD critical E-O Manufacturing Science and Technology and to promote U.S. preeminence in all areas of E-O. Alliance membership is available at no cost to all U.S. companies, government labs, and academic institutions involved in E-O technology. The Alliance is committed to advancing the commercial viability of E-O

technologies and promoting technology transfer to industry, as well as wide dissemination of new E-O related information. U.S. organizations with capabilities in E-O science and technology are encouraged to join the Alliance by visiting the EOC Web site and completing a membership application.

EOC Web site: http://www.electro-optics.org

Electronics Manufacturing Productivity Facility

The Electronics Manufacturing Productivity Facility (EMPF) was established in 1984 to aid the electronics industry in improving electronics manufacturing processes required in the manufacture of military systems. Today, the EMPF operates as a national electronics manufacturing COE focused on the development, application, and transfer of new electronics manufacturing technology by partnering with industry, academia, and government centers and laboratories to maximize available research capabilities at the lowest possible cost. The EMPF serves as a corporate residence of expertise in electronics manufacturing. The EMPF's principal goals are to: improve responsiveness to the needs of DOD electronics systems; ensure that deliverables make a significant impact in the electronics manufacturing industry; facilitate the development and transition of technology to the factory floor; and expand the customer base to a national level.

The EMPF operates in a modern 36,000 square foot facility adjacent to the Philadelphia International Airport. The facility houses a demonstration factory containing the latest electronics manufacturing equipment, fully equipped classrooms for skill-based and professional level technical training, and an analytical laboratory for materials and environmental testing. The EMPF offers many electronics manufacturing services and capabilities to the U.S. Navy, DOD, and the U.S. electronics manufacturing industrial base. The EMPF's resident technical staff consists of the nation's leading electrical engineers, mechanical engineers, materials scientists, chemists, physicists, instructors, and technicians. The EMPF staff is dedicated to the advancement of environmentally safe electronics manufacturing processes, equipment, materials and practices; flexible electronics manufacturing technologies; and workforce competency in advanced electronics manufacturing.

EMPF Web site: http://www.empf.org

Energetics Manufacturing Technology Center

The Energetics Manufacturing Technology Center (EMTC), established in 1994, is Navy-operated and located at the Naval Sea Systems Command's Naval Surface Warfare Center (NSWC), Indian Head Division, Indian Head, MD. A renowned leader in energetics, the Indian Head Division serves as the focal point for this group and provides a full spectrum of capabilities including energetics research, development, modeling and simulation, engineering, manufacturing technology, production, test and evaluation, and fleet / operations support.

Energetic materials (reactive chemicals), formulations (propellants, explosives, pyrotechnics), and subsystem components (fuzes, detonators, boosters, igniters, safe and arm devices) are critical to the

performance and reliability of weapon systems as well as to our Nation's defense. Applications include missile, rocket, and gun propulsion; stores or ordnance separation; warheads and munitions; obstacle and mine clearance; flares; decoys; fire suppression; and aircrew escape. Energetics, inherently dangerous, require special processes, equipment, facilities, environmental considerations, and safety precautions. At EMTC, this is kept in mind while ensuring the availability of safe, affordable, and quality products. The Center develops solutions to manufacturing problems unique to military system / subsystem acquisition and production requirements and the energetics industry.

The Center does not own or operate any facilities and equipment but is essentially a virtual enterprise that involves government, industry, and academia in identifying requirements and executing projects. EMTC objectives are to identify weapon system and manufacturing base needs, develop and demonstrate the required manufacturing process technology solutions, and finally transition successful results.

EMTC Web site: http://www.ih.navy.mil/Directorates/cao/emtc/index.asp

Institute for Manufacturing and Sustainment Technologies

The Institute for Manufacturing and Sustainment Technologies (iMAST), established in 1995, coordinates Navy ManTech efforts at The Pennsylvania State University's Applied Research Laboratory (ARL), one of four U.S. Navy University Affiliated Research Centers (UARCs). Located in State College, PA, iMAST's primary objective is to address challenges related to Navy and Marine Corps weapon system platforms in the following technical areas: mechanical drive transmission, materials processing, laser processing, advanced composites, manufacturing systems, repair and sustainment, and complex systems monitoring. iMAST supports the Navy and Marine Corps systems commands, as well as PEOs and Navy laboratories.

REPTECH applies new and emerging technologies to improve capabilities of Navy depots, shipyards, Marine Corps Logistics Bases, and lower level maintenance activities throughout the Fleet. REPTECH cooperates and communicates with Navy COEs, the joint depot community, DOD industrial activities, industry, PEOs, and university laboratories.

iMAST Web site: http://www.arl.psu.edu/capabilities/mm_imast.html

Navy Joining Center

The Navy Joining Center (NJC) was established in 1993. The Center is operated by Edison Welding Institute (EWI) and is located in Columbus, OH.

Materials joining is a primary means of fabricating and maintaining the fleet, aircraft, weapons, and the advanced electronics that are the core of modern Navy forces. Implementing the best materials joining technologies is critical to improving the performance of Navy weapon systems and increasing the productivity of manufacturing practices needed to reduce the acquisition costs of these systems. The NJC provides a national resource for the development of materials

joining expertise and the deployment of emerging manufacturing technologies to Navy contractors, subcontractors, and other activities. The NJC team represents a collaborative effort among industry, academia, and government and is experienced in identifying joining problems, developing and deploying solutions, and transferring technology.

The NJC disseminates project results and other joining information through demonstrations, workshops, conferences, publications, and a Joining Technology Information network. Typical projects provide joining solutions for metallic, non-metallic, ceramic, and composite materials that support Navy ManTech strategic plans.

NJC Web site: http://www.ewi.org/njc

Navy Metalworking Center

The Navy Metalworking Center (NMC) is the national resource for the development and transition of advanced metalworking and manufacturing technologies, materials, and related processes. Established in 1988 to address Navy and DOD metalworking needs, NMC works in partnership with government, industry, weapon systems prime contractors, and Program Offices to develop and apply innovative technologies. NMC drives new technologies from research and development to naval weapon systems application with two objectives: 1) to implement new technologies that will improve weapon system performance; and 2) to develop new production means for weapon systems prime contractors and suppliers that lower the production cost of naval weapon systems.

For more than twenty years, NMC has supported the Navy with affordable new metalworking technologies and capabilities that have responded to increasingly stringent requirements for greater agility, survivability, and lethality. NMC is operated by Concurrent Technologies Corporation (CTC), an independent, nonprofit organization located in Johnstown, PA.

NMC Web site: http://www.nmc.ctc.com

As previously indicated, the emphasis of the Navy ManTech Program is on transition of manufacturing technology that will result in tangible benefits for the fleet. To achieve transition, it is imperative that the manufacturing advances be widely disseminated to the industrial base for implementation. To foster that dissemination, Navy ManTech provides the following:

Program Web Site

The **Navy ManTech Program Web site** can be accessed at http://www.onr.navy.mil/sci_tech/3tmantech/. The Web site is a central source for accessing general information about the program, program activities and participation, developments and events, and key points of contact. The site also offers links to the online annual Navy ManTech Project Book, program success stories, as well as other publications and reports.

Defense Manufacturing Conference

The annual **Defense Manufacturing Conference (DMC)** is a forum for presenting and discussing initiatives aimed at addressing DOD manufacturing technology and related sustainment and readiness needs. The conference includes briefings on current and planned programs, funding, DOD initiatives, and seminars relating to the various technology thrusts currently being pursued. Further details are available at the DOD Manufacturing Technology Web site at: https://www.dodmantech.com.

Project Book

The **Navy ManTech Project Book**, published annually and available through the Navy ManTech Web site, is a snapshot of Navy ManTech projects active during that particular fiscal year. Points of contact for each project are provided to facilitate technology transfer.

Centers of Excellence

The **Navy COEs** are focal points for specific manufacturing technology areas. The charter for each COE requires it to act as a consultant to both the Navy and industry and to facilitate the transfer of technology throughout the industrial base.

The Navy urges government activities, industry, and academia to participate in its ManTech Program as participants, advisors, consultants and, most importantly, as beneficiaries. The goal of developing and implementing new and improved technologies will be achieved only through a concerted effort by everyone connected with the design, manufacture, and repair and sustainment of naval weapon systems.

For additional information on participation in the Navy's effort to strengthen the U.S. industrial base, impact platform affordability, and increase Navy readiness, contact any of the 2010 Navy ManTech Points of Contact.

The four major acquisition platforms (VCS, CVN 78 Class, LCS, and DDG 1000) that ManTech focuses on for affordability.

Navy ManTech's Focus On Transition and Implementation

Over the past four years, the focus of Navy ManTech has changed from improving manufacturing processes and procedures for increased performance and generic technical benefits to improving and enabling the affordable manufacture of Navy systems and platforms. Technical success of a Navy ManTech project that provided the shelf-ready capability to manufacture advanced components and subsystems has been replaced by an emphasis on near-term solutions to the current manufacturing needs of acquisition systems. The focus is on affordability.

To improve the likelihood that ManTech results will transition and be implemented, Navy ManTech has instituted the following actions and processes:

1. **Increased Program Office and Industry Interaction:**

   - The Navy ManTech office interacts with the acquisition offices and their supporting technical experts regarding the capabilities and resources of ManTech and the highest priority manufacturing concerns of the program office. Navy ManTech maintains a close partnership with the Platform / Weapon System Program Offices and relevant industrial facilities / shipyards. It is through this ongoing close contact and open communication with both Program Offices and the industrial facilities that ManTech receives data on transition, implementation, and any applicable cost savings and/or other benefits.

   - The COEs are encouraged to interact with their counterparts in industry as well as with PMs and PEOs to educate them on the COEs' resident expertise and to identify manufacturing needs that the COEs may be able to assist in solving. Since current Navy emphasis is on affordability, all parties are searching for manufacturing techniques or procedures that will assist in reducing production costs.

2. **Quarterly Review Meetings:** Once ManTech projects that will benefit a particular acquisition program are underway, Quarterly Review meetings (with that acquisition Program Office, Navy ManTech COEs, and relevant industry) are held to provide technical and schedule status of the projects and to further an understanding of what is needed and when, and, what ManTech will deliver and when.

3. **Technology Transition Plans:** All proposed ManTech projects must have a Technology Transition Plan (TTP) that clearly defines what ManTech will transition and when as well as what efforts are needed to achieve implementation, what entities will conduct them, who will fund these efforts, and the schedule for implementation. The TTP specifies the Navy need for the technology developed by the project, the specific event that will signify ManTech transition, the criteria that the project must meet for transition, the requirements for implementation (i.e., implementation actions and roles, responsibilities, and required resources), and the schedule.

Navy ManTech's Focus On Transition and Implementation

To identify how well these actions are at improving transition and implementation, Navy ManTech instituted tracking processes at the start of FY09. The results, so far, are strongly indicative of the benefits of the Navy ManTech Program. A total of twenty-eight projects resulted in implementations during FY09. Several of the projects implementing this year have implementations on more than one platform; some have implementations on one platform but in multiple industry locations; and several have multiple implementations resulting from the differing technologies resulting from a single project. Implementations for the four major platforms included seven for CVN 78 Class, eight for DDG 1000, one for LCS, and twelve for VCS. NAVSEA, NAVAIR, and Marine Corps implementations also were achieved. Five of the projects implemented have immediate applicability to additional platforms.

Transition of manufacturing technologies developed under Navy ManTech that have been implemented for the production of the VIRGINIA Class Submarine is an ongoing major Navy ManTech affordability success. The current ManTech VCS portfolio contains approximately 60 completed, active, or pending projects focused on VIRGINIA Class manufacturing technology priorities with a planned ManTech investment of approximately $60M. This current portfolio has a potential total cost savings of approximately $32M per hull for a return on investment in less than two hulls (as of Aug 2009 Affordability Assessment which was vetted through PMS 450 in late September 2009).

Prior to FY09, seven of the ManTech affordability projects had completed and were in various phases of implementation. Realized cost savings/hull of $6.57M was recognized by the VIRGINIA Class Program Office and General Dynamics Electric Boat and were negotiated into the Block III VIRGINIA Class submarine procurement in December 2008. By September 2009, fourteen projects had implemented or were credited as being implemented for a combined cost savings of $13.4M per hull. It is expected that this success with VIRGINIA Class Submarine will continue and that additional ManTech investments, resulting in future implementations, will further reduce the cost of the VCS system.

VIRGINIA Class attack submarine USS New Hampshire (SSN 778) returns to Submarine Base New London after completing her maiden deployment. (U.S. Navy photo by John Narewski / Released).

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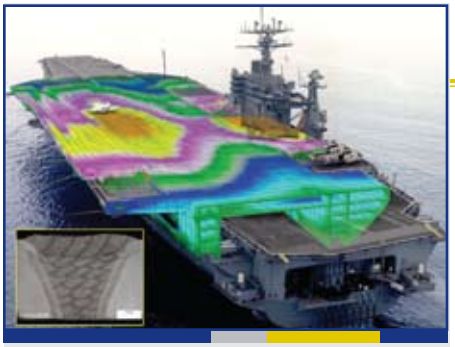
Manufacturing Technology Program

CVN 78 Class / Carriers Projects

Welding Development Aids in Flight Deck Weight Savings



PERIOD OF PERFORMANCE:

May 2004 to December 2008

PLATFORM:

CVN 78 Class

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC and NJC

POINT OF CONTACT:

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$1,291,000

S2022 — Welding Development for High Strength Steel

Objective

Steel with increased strength has the potential to replace the currently used High-Strength Low-Alloy (HSLA-100) steel for selected applications and reduce the weight of CVN 78 Class. However, further development is needed on the steel itself and on the fabrication technologies that Northrop Grumman Shipbuilding – Newport News (NGSB-NN) will use for ship construction. Welding is one of these needed fabrication technologies. The Navy Metalworking Center led in the overall steel development for this project and as a subtask to this, the Navy Joining Center (NJC) led the weld development activity. Steel development efforts have shown that the most feasible means of achieving the weight reduction and performance goals is to modify the processing of HSLA-100 steel to produce steel with minimum yield strength of 115 ksi (HSLA-115). The objectives of the NJC project were to develop welding procedures to increase productivity for fabrication of HSLA-115 steel while meeting the undermatching weld metal performance requirements. Development focused on optimized welding electrodes and procedures to produced welds with requisite yield strength, ductility, and toughness at minimum cost.

Payoff

Weld development for the HSLA-115 high-strength steel will enable reductions in thickness of the flight and gallery decks. This corresponds to approximately 120 long tons of weight reduction and a lower center of gravity. The reduced weight for an enlarged flight deck resulted in a 15% increase in sortie rates for this carrier class. A secondary benefit from the project was total ownership cost avoidance due to the development of efficient and productive welding procedures which minimized the fabrication costs for this new steel and reduced the learning curve for shipyard implementation. Further details of payoff metrics are not available at this time for release outside the project team. The technology developed during this project also has applications on other Navy ships.

Implementation

The implementation plan is structured to satisfy the design and construction schedule requirements for the production of CVN 78 Class. The project supported the Material Selection Information (MSI) documentation and requirements, which was approved in January 2009. NGSB-NN procured HSLA-115 for construction of the first Unit #4716A on CVN 78 Class in March 2009. The Integrated Project Team, which included PEO (Carriers) and NGSB-NN, will facilitate successful implementation of the technology developed during this project to the Navy and the shipyard.

Note: This project is led by the Navy Metalworking Center (NMC) with a portion of the work performed by the Navy Joining Center (NJC).

New Watertight Door Design Provides 27% Weight Savings

S2031 — Advanced Surface Ship Watertight Enclosures

Objective

Navy standard watertight doors (NSWDs), designed in the early 1950s, are expensive to install and maintain and are too heavy for today's needs. Watertight doors are usually at or near the top of the Navy's Top Management Attention (TMA) list for hull, mechanical, and electrical (HM&E) systems requiring frequent maintenance due to poor functioning, corrosion, and loss of water-tightness. To maximize substitution opportunities on CVN 79, this project focuses on the 26 inch x 66 inch, 10 lbs per square inch interior door, weighing 292 pounds, with eight latching dogs and a 6-inch diameter window. The objective is to specify a new interior watertight door for the CVN 79, featuring improvements over the NSWD and incorporating advances in materials, design, and manufacturing processes including, but not limited to: stainless steels, cellular sandwich panels, a novel hydrostatically actuated seal, new latching mechanism, distortion-reducing plug-in-hole installation, and highly accurate, high-speed, automated laser cutting and welding processes. Tasks were added in FY07, FY08, and FY09 with the objective of decreasing manufacturing and installation costs.

Payoff

The new door weight is 213 lbs, which represents a 27% reduction, as compared to the NSWD. Reducing the weight of the doors allows increased alternate weight allocation opportunities for armor, ordinance, cargo, and other warfighting-related functions, while maintaining stability. Reduced installation and maintenance costs due to low distortion plug-in-hole installation, and the use of a more corrosion-resistant material (304 stainless steel) than the low carbon steel (A-36) used in the NSWD, combined with reasonable manufacturing costs, will result in a reduction of total ownership costs, providing more resources for the warfighter. The reduction in maintenance time and cost is estimated at about 80% resulting in estimated annual cost savings of over $200K per year.

Implementation

The new door has been fabricated at Penn State University's Applied Research Laboratory (ARL) and by external manufacturers who provide doors for a testing program that includes hydrostatic, shock and cyclic testing. Northrop Grumman Shipbuilding - Newport News (NGSB-NN) is documenting the installation process and investigating methods for reducing costs. Manufacturing specifications for an optimized design of an interior watertight door for the CVN 79 will be provided to PMS 378 when the project is completed. On this project, ARL Penn State University's Institute for Manufacturing and Sustainment Technologies (iMAST) teamed with the Naval Surface Warfare Center - Carderock Division for Navy in-service experience and their expertise in functional and performance requirements of watertight doors and with NGSB-NN for their expertise in door installation and shipbuilder requirements.

PERIOD OF PERFORMANCE:

June 2004 to December 2009

PLATFORM:

CVN 78 Class / Carriers

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$2,638,000

Alloy 625 Forming Parameters Developed for Critical CVN 78 Class Components

S2102 — Alloy 625 Formability for Future Carriers

PERIOD OF PERFORMANCE:

February 2007 to October 2009

PLATFORM:

CVN 78 Class

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$2,054,000

Objective

Alloy 625 is difficult to form, particularly at lower temperatures. The objective of this project was to reduce potentially significant schedule delays by identifying optimal forming practices for Alloy 625 in several critical CVN 78 Class components as well as evaluating the corrosion performance of the Alloy 625-to-HSLA (high strength, low alloy) steel welds.

Payoff

The primary benefit of this project was to develop the necessary forming practices to enable Northrop Grumman Shipbuilding - Newport News (NGSB-NN) to successfully form several complex shapes on the first attempt. The project results will minimize the risk of cracking this very expensive material, which could result in significant schedule delays and costs to re-form these shapes.

Implementation

Fabrication of these components was planned very early in the production cycle for CVN 78 Class, which made it necessary to accelerate the development of the required forming practices in this project. The forming practices were transitioned to NGSB-NN in July 2008, which was in sufficient time to support the production schedule for these critical components. The specifications and procedures developed during this project directly translated into NGSB-NN procurement specifications, drawing callouts, tooling design, and process instructions to support the fabrication of these components for CVN 78 Class.

Tandem Gas Metal Arc Welding Offers Significant Cost Reduction Opportunity

S2123 — Tandem GMAW for Ship Structures

Objective

The Navy Joining Center (NJC) is participating in an integrated project team along with PMS 378, PMS 450, Northrop Grumman Shipbuilding - Newport News (NGSB-NN), and Naval Surface Warfare Center - Carderock Division (NSWC-CD) to develop and implement high productivity Tandem Gas Metal Arc Welding (T-GMAW) for out-of-position mechanized butt welding of high-strength steel erection joints for ship structures. The NJC objective is to develop and demonstrate welding procedures necessary to support the required productivity improvements. The technology will initially be implemented at NGSB-NN for CVN 78 Class horizontal butt joints and overhead joints for the flight deck and later for horizontal welding of VIRGINIA Class submarines (VCS) modules. The welding technologies developed during this project are expected to have wider applications to other Navy ships, including DDG 1000 and T-AKE ships for the Military Sealift Command.

Payoff

Tandem GMAW has the potential to increase deposition rates by a factor of 2 or more over conventional mechanized GMAW. Preliminary estimates on the amount of out-of-position welding are approximately1,400 feet for VCS and 5,800 feet for CVN 78 Class. This represents over 30,000 labor hours annually. Two- to three-fold improvements in deposition rate offer the potential for significant labor hour reductions. Additional cost reductions are expected through an increase in weld quality. The T-GMAW process has been shown to reduce weld root defects and improve weld bead profile with proper optimization. A cost avoidance of approximately $750K per hull for CVN is anticipated.

Implementation

The Integrated Project Team includes PEO (Carriers), PEO (Subs), and NGSB-NN to help ensure implementation of the T-GMAW on both SSN 781 and CVN 78 Class. In Phase Three of the project, a shipyard system will be acquired by NGSB-NN. Procedures will then be refined, qualified, demonstrated, and validated. NGSB-NN has stated their intent to implement the developed welding procedures pending the results of the project. Initial implementations of these technologies are expected to occur in late calendar year 2009.

PERIOD OF PERFORMANCE:

April 2006 to September 2010

PLATFORM:

CVN 78 Class

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$873,000

Tools Developed to Reduce Planning and Scheduling Delays of CVN 78 Construction

PERIOD OF PERFORMANCE:

February 2007 to March 2009

PLATFORM:

CVN 78 Class

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$250,000

S2167 — CVN Virtual Erection Visualization

Objective

The project objective was to develop a tool to visualize the 3-dimensional erection of a CVN 78 Class hull, allowing for immediate validation of resequencing due to build strategy modifications or modifications to the construction schedule. The intent was to extend Activity-based Spatial Scheduling Tool (ABSST) development to include new dockside facility dedicated to the construction of high-value CVN 78 Class assemblies to ensure on-time shipboard installation.

Payoff

It is estimated that this project over a four year construction period for a CVN 78 Class hull will lead to an estimated $5M per hull cost avoidance and a Return on Investment (ROI) of 19.8:1.

Implementation

The ABSST has been transitioned to Northrop Grumman Shipbuilding - Newport News (NGSB-NN) for the new dockside facility. The facility is planning to open for operations in early CY10. Full implementation of the ABSST for advanced planning of the new facility was planned for August, 2009. The 3D Erection Visualization Tool (EVT) software, integrated with the already implemented Final Assembly Platen (FAP) spatial scheduling tool, has been completed and demonstrated to process owners at NGSB-NN.

Full transition was not attained due to the lack of lightweight digital models for all CVN erection blocks which must be provided by NGSB-NN. It was agreed at project completion that NGSB-NN would seek additional funding for the development of the lightweight digital models, and, if successful, Applied Research Laboratory (ARL) Penn State would continue the project with a transition support task planned for FY10 (ManTech project extension).

LASCOR Reduces Weight and Cost for CVN 78 Class and DDG 1000 Applications

S2170 — LASCOR Panel Evaluation and Implementation Phase 2

Objective

The Navy is seeking solutions to reduce weight and lower the center of gravity for surface ships to improve their performance at a reasonable cost. LASer-welded corrugated-CORe (LASCOR) metallic sandwich panels are stiff, lightweight steel structures that offer the Navy corrosion resistance, reduced weight, and less distortion. The objective of this Navy Metalworking Center (NMC) project was to complete the tasks needed to support the transition of LASCOR to future Navy applications. This was accomplished by optimizing the LASCOR design for materials, manufacturability, joining, structural and protection performance, and cost.

Payoff

The use of LASCOR technology offers a lightweight, stiff, and modular structural steel system to reduce weight and improve performance. It is expected that LASCOR structures will result in a weight reduction of between 15% and 30% over conventionally fabricated structures.

Implementation

LASCOR is being evaluated for future applications on CVN 78 Class in parallel with fabrication of various prototype panels to demonstrate manufacturability. Provided that LASCOR designs offer the shipyard improved performance or cost reduction, LASCOR may be incorporated into baseline designs for future construction. Also, LASCOR is being considered for other ship platform use, and this project helped to streamline future shipyard implementation efforts.

Based on the work conducted under this project, a competitive bid initiated by General Dynamics Bath Iron Works (BIW) resulted in a multi-million dollar contract to develop, test, and manufacture ship sets of Deck Edge Safety Berms and Personnel Safety Barrier Panels for DDG 1000 using hybrid laser-welded metallic sandwich panel technology, with approximately 84 panels per hull. This technology was selected as the low-cost, technically compliant solution to meet weight, structural, heat, and other requirements while offering corrosion resistance, reduced weight, and less distortion. The first two ships of the DDG 1000 class are being built by BIW; the two ship sets of panels are scheduled for delivery by October 2011.

PERIOD OF PERFORMANCE:

February 2007 to
September 2009

PLATFORM:

CVN 78 Class

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$2,999,000

HSLA-115 in CVN 78 Class Baseline Design Results in Reduced Weight Per Hull

PERIOD OF PERFORMANCE:

February 2007 to February 2010

PLATFORM:

CVN 78 Class

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$ 3,639,000

S2171 — HSLA-115 Evaluation and Implementation Phase 2

Objective

The Navy is seeking solutions to reduce weight and lower the center of gravity for CVN 78 Class to improve performance at a reasonable cost. The goal of this Navy Metalworking Center (NMC) project is to increase the performance and strength of HSLA-100 (high-strength, low alloy) steel through heat treatment to enable use of this new HSLA-115 (115 ksi yield strength) steel at reduced thickness, and thus, reduced weight, while meeting all performance requirements. Additional objectives are to evaluate HSLA-115 for a large-scale production plate application, to determine HSLA-115's performance and manufacturability, and to achieve welding and shipyard practice optimization and vendor qualification.

Payoff

Implementation of HSLA-115 for the target application on CVN 78 Class will result in 100 to 200 long tons of topside weight reduction per hull and achievement of a 0.05-ft KG recovery. In addition, Northrop Grumman Shipbuilding - Newport News (NGSB-NN) conducted a trade-off study and determined HSLA-115 to be cost-neutral compared to the HSLA-100 baseline. While the HSLA-115 steel cost is slightly higher than HSLA-100, the weld volumes will decrease 10% due to thickness decrease. Also, current shipyard flux-cored, SMAW, GMAW and SAW welding processes have been approved for use with HSLA-115, so a $1M acquisition cost increase was avoided. Finally, the improved minimum yield strength level of the HSLA-115 also offers enhanced factor of safety in areas where the application thickness may not be reduced, but where the design performance and strength are enhanced without a weight penalty. Additional applications may be considered in future weapon system designs.

Implementation

The Future Aircraft Carriers Program Office has approved the use of HSLA-115 in the CVN 78 Class baseline design, and HSLA-115 has been incorporated into the ship specifications and the fabrication document. NGSB-NN procured the first order of HSLA-115 for CVN 78 Class in March 2009 for the first unit; construction is scheduled to begin in December 2009. More than 2000 tons of HSLA-115 will be ordered for CVN 78 Class. Implementation of HSLA-115 was achieved ahead of schedule due to the combined efforts of the Integrated Project Team (IPT). The IPT, which includes NAVSEA 05, PMS 378, Naval Surface Warfare Center - Carderock Division, Office of Naval Research, NMC, Navy Joining Center, ArcelorMittal USA and DDL Omni, was instrumental in achieving the required steps toward implementation. These steps included obtaining NAVSEA approval of the Material Selection Information (MSI) after extensive certification testing, first article testing and vendor qualification, survivability testing for both plates and weldments, and NGSB-NN's weld cross qualification. In addition, NGSB-NN demonstrated acceptable forming and welded tie-down behavior with HSLA-115.

Automation Optimized to Improve Overall LASS Yield and Reduce Final Cost

S2173 — Manufacturing of Light Activated Semiconductor Switches Phase 3

Objective

Advanced weapons and defense systems for meeting mission requirements for lethality and survivability require the use of high power, very fast switching (high dI/dt) switches that are cost-effective to manufacture. Gas and vacuum switches have the potential to meet the performance requirements, but their reliability over repeated operation and cost of ownership preclude their use. The logical alternative to meet these demanding requirements is the use of solid state switches, since their reliability and lifetime are much greater than gas or vacuum switches. However, existing solid state switches do not simultaneously meet the high current and high dI/dt requirements. The Light Activated Semiconductor Switches (LASS) program has developed a manufacturing supplier of solid state switches that meet DOD requirements for a high current, high dI/dt switch. The objective of this project was to establish a manufacturing line to provide LASS switches for military and commercial applications. The Technical Readiness Levels (TRLs) of the LASS and its components were assessed at regular intervals during the program.

An additional objective of this project was to demonstrate a LASS at TRL 5. This project addressed the following areas: (1) development of lower cost silicon doping processes to improve the lifetime and uniformity of high power silicon devices; (2) manufacturing process development for high voltage devices; (3) packaging of high power, light activated thyristors; (4) development of a fiber optic coupled laser light source; (5) integration and testing of the laser light source; and (6) integration and testing of the LASS thyristor package and integrated laser light source.

Payoff

The demonstrated benefits were that a manual manufacturing operation was converted into an automated manufacturing facility that is capable of producing a significantly higher volume of LASS switches with a much improved process yield. Costs were significantly lower and a savings of $20K per switch is expected with an initial production of 300 switches planned. The total cost reduction is $6M.

Implementation

Phase 3 of this project optimized the processing, packaging, and manufacturing automation improving overall LASS yield and reducing the final cost. The ManTech project developed a manufacturing line at OptiSwitch Technology Corporation (OTC) that is capable of providing a sufficient number of LASS devices for DOD needs. Environmental testing has been completed on all major components of the Light Activated Semiconductor Switch to determine how well they perform in a relevant environment. The transition event for this project, the demonstration that the LASS meets the TRL 5 requirements, has been completed. Implementation will be accomplished by qualifying the Light Activated Semiconductor Switch in the test bed of a DOD mission critical application.

PERIOD OF PERFORMANCE:

January 2007 to September 2009

PLATFORM:

CVN / Carriers

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Electronics

CENTER OF EXCELLENCE:

EMPF

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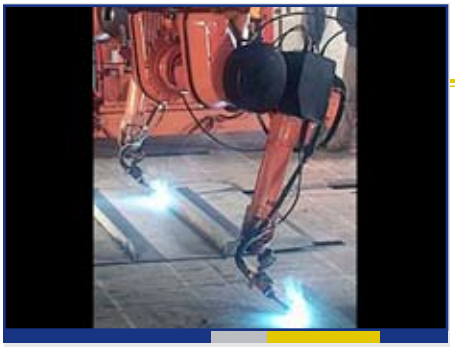
STAKEHOLDER:

DOD Weapon System Applications

TOTAL MANTECH INVESTMENT:

$5,307,000

Optimized Welding for Thin Panels Expected to Result in Cost Reduction of $2.4M Per Hull for CVN 78 Class



PERIOD OF PERFORMANCE:

April 2008 to April 2011

PLATFORM:

CVN 78 Class

AFFORDABILITY FOCUS AREA:

Distortion Reduction

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$2,169,000

S2198 — Control of Thin Panel Distortion

Objective

Operational requirements for the CVN 78 Class aircraft carrier require reducing the weight of ship structures. Therefore, CVN 78 Class will be constructed of much lighter weight sponsons, decks, bulkheads, and other structures than previous aircraft carriers. It is well documented that distortion due to thermal cutting and welding becomes a significant manufacturing problem as the thickness of plates and panels is reduced. Thin steel panels are more likely to deform and production of these panels is more difficult since the structures lack rigidity until integrated into a unit. Distortion of thin panels makes it more difficult to fit and weld subsequent assemblies and units, as well as to meet fairness and straightness requirements. Distortion repair costs include rework of unit fit-up, flame straightening, and rewelding. The result is increased ship construction costs and longer schedules. Navy acquisition costs can be significantly reduced by implementing new production processes that minimize bucking distortion of lightweight structures. The objective of this project is to apply new technologies and best practices to reduce distortion for CVN 78 Class thin ship panel structures.

Payoff

Implementation of this project will reduce production hours required to achieve dimensional control of structures during the construction of the CVN 78 Class aircraft carrier. Without improved control of distortion, the labor hours that would be needed to correct distorted structures on the CVN 78 Class aircraft carrier are projected to increase by 30% compared to those expended during the construction of CVN 77. Approximately half of the cost is the labor required to correct distortion during the fitting of subassemblies and units. An equal amount of labor is required for flame straightening to meet fairness requirements of final assembled units. The goal for this project is to reduce these labor-hours by 20% for the remainder of the CVN 78 construction at a cost benefit estimated to be $2.4M per hull.

Implementation

The distortion control technology for thin panel fabrications that results from this ManTech project will be implemented by Northrop Grumman Shipbuilding - Newport News (NGSB-NN) on the CVN 78 Class aircraft carrier. Implementation will begin with the fabrication of thin panels for the second deck thin plate structure, scheduled to begin in the first quarter of 2010.

High Power, High Temperature Packages to Reduce Weight and Size of Naval Power Conversion Equipment

A2213 — High Voltage Encapsulation for High Power SiC Device Packaging

Objective

The Navy's next generation surface combatants will require a fundamental change in how electric power is converted, distributed, and managed to fully use the electric power available. Current ideas for generating pulsed power require the use of heavy, bulky systems placed in areas not optimal for carrier design. One method to reduce the weight and size of the current iron and copper transformers used in legacy power distribution systems is to use a solid state transformer to combine power electronics with a transformer that is reduced in size due to the increased operating frequency of the power electronics.

The new Wide Band Gap (WBG) semiconductor materials, principally SiC, operate at higher temperatures and require less cooling. The higher blocking voltages and lower switching loss at high frequency of SiC devices allow for the use of smaller transformers and inductors. Power conversion equipment developed using SiC technology is projected to significantly reduce the workload and maintenance requirements of future ship platforms that required high power distribution systems. Improved thermal management of semiconductors and passive components through ungraded packaging would allow more current to be handled by a given device and lead to improved power density designs. The development of a 2.7 MVA Solid State Power Substation (SSPS) has been identified as a first demonstration vehicle. The objective of this project is to develop and demonstrate the reliability of a high temperature packaging methodology that is applicable to current power devices / modules as well as readily adaptable to future power device technology.

Payoff

This effort is developing and demonstrating the reliability of a manufacturing technology for high temperature packaging that will advance the overall power components industry. These materials and processes will be applicable to the present silicon-based power devices / modules, as well as future SiC-based modules. The end result will lead to more versatile power electronics packaging materials for operation above 10kV and 150-200°C. This packaging effort will enable the Navy to realize the high temperature operation potential of WBG semiconductor materials with packaging materials technology that meets SSPS operational specifications not currently offered by the power electronics industry. The power electronics components produced using this new manufacturing technology will enable the design and development of power distribution systems that are 60% smaller and weigh 2.68 tons less than current systems.

Implementation

At the conclusion of the ManTech project, the manufacturing technology will be implemented at Powerex Inc. for use in the manufacturing of power electronics modules specified by the SSPS program and the All-Electric ship, as well as components required for other DOD programs.

PERIOD OF PERFORMANCE:

July 2007 to October 2009

PLATFORM:

CVN 78 Class / Carriers

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EMPF

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STAKEHOLDER:

DOD Weapon System Applications

TOTAL MANTECH INVESTMENT:

$1,071,000

Web-Based Welding Procedure Greatly Reduced Costs Associated with Rejected Vendor Submissions

S2228 — Web-Based Welding Procedure System

PERIOD OF PERFORMANCE:

December 2007 to May 2009

PLATFORM:

CVN 78 Class

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$827,000

Objective

The Navy's requirements for qualification of welding procedures and welder performance can make it difficult for inexperienced vendors to develop the required documentation. In fact, Northrop Grumman Shipbuilding - Newport News (NGSB-NN) has reported that a large percentage of vendor-submitted weld procedures are rejected, with many vendors resubmitting procedures multiple times before gaining approval. While commercially available software exists to help develop procedures for American Welding Society, American Society of Mechanical Engineers, and other commercial specifications, no equivalent tool exists for Navy specifications. The Navy Metalworking Center developed a Web-based welding procedure system intended to reduce the rejection rate of vendors' submitted procedures, along with the resulting additional costs. This project, which includes contributions from Weld QC, NGSB-NN, General Dynamics Electric Boat (GDEB), the Future Aircraft Carriers Program Office and Naval Surface Warfare Center Carderock Division, leveraged a prototype system that was developed and demonstrated under a Small Business Innovative Research (SBIR) project sponsored by ONR and extended its capabilities and cost savings.

Payoff

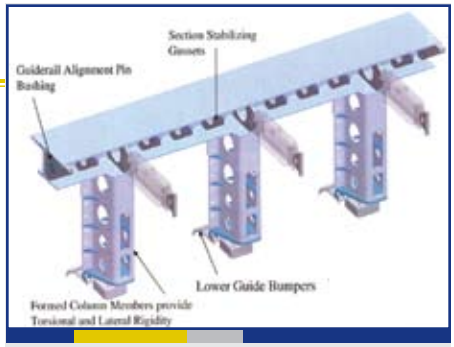
As a result of the reduced rejection rate of vendors' submitted welding procedures, cost savings will be generated from reduced labor and production delays, increased competition among vendors, better vendor retention, and welding engineers' increased availability to focus on other process improvements. The project goal to reduce the rejection rate from above 90% to less than 20% has been met. Estimated annual savings is approximately $2.58M from vendor and shipyard labor savings alone.

Implementation

Implementation began in August 2009 with a scaled set of NGSB-NN vendors for the CVN 78 Class aircraft carrier. Subsequently, this implementation will be extended for use by all CVN 78 Class vendors. NGSB-NN is in the process of modifying licensing agreements with Weld QC to extend the use of this software tool to the Northrop Grumman Shipbuilding – Gulf Cost (NGSB-GC) operations as well. GDEB has reported that implementation will begin in September 2009 for the VIRGINIA Class Submarine Program. The software system is also applicable to most non-nuclear-related welding on CVN 79, DDG 1000, Littoral Combat Ship, Amphibious Transport Dock, and Auxiliary Dry Cargo Carrier.

Improved Fabrication Process for Electromagnetic Aircraft Launch System (EMALS)

S2249 — CVN Manufacturing Support for EMALS



Objective

The Electromagnetic Aircraft Launch System (EMALS) motor support structure (MSS) is a very complex weldment of HSLA- 100 steel plates. Extensive welding and cladding operations during fabrication lead to distortion. To meet final dimensional requirements, oversized stock is used in portions of the structure. During fabrication, incremental cold straightening is required. Several machining operations are required to remove excess material and achieve final dimensions. The current manufacturer has been experiencing difficulties in delivering a MSS that meets the required dimensions due to numerous distortion issues encountered during and after welding. This has led to production delays and cost overruns.

The objective of this effort is to improve the fabrication process of the MSS by the development of a thermal stress relief cycle for HSLA-100. The use of alternative forming operations such as extrusion, casting or forging to improve the MSS fabrication will also be examined.

Payoff

Currently available cost estimates based on structural detail design data for a ship's set of motor support structures estimates current cost of $46.4M. A cost reduction of at least 25%, or $11.6M, is believed to be attainable, along with a reduction in delivery time and reduced life cycle costs, by developing a solution for the current manufacturing issues.

Implementation

The solutions developed in this project related to the manufacture of the motor support structure will be implemented on both CVN 78 and CVN 79 as is practical. The MSS is an integral part of the EMALS. The current fabricator of the MSS in closely involved in the project to ensure that implementation is feasible. The Naval Air / Naval Sea Systems Commands are committed to implementing the improved materials and manufacturing process developed pending technical success of this project.

PERIOD OF PERFORMANCE:

January 2009 to January 2011

PLATFORM:

CVN 78 Class

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements - Metals

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$550,000

Ultrasonic Testing Provides a Safer, Less Disruptive Alternative to Radiography for Inspection

PERIOD OF PERFORMANCE:

April 2009 to March 2011

PLATFORM:

CVN 78 Class

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$997,000

S2253 — Ultrasonic Testing as an Alternative to Radiography for the Inspection of Naval Piping, Pressure Vessel and Machinery Welds

Objective

Radiographic inspection (RT) is currently required to perform nondestructive examination of piping (e.g., main steam), pressure vessel (e.g., steam accumulator tank) and machinery (e.g., sea chest) welds. In the later phases of carrier construction where most of the welding is performed, shipboard, radiography becomes a production obstacle. Due to the hazardous nature of radiography, this technology requires support on backshifts and the roping off of large radiation boundaries on the carrier to minimize exposure to personnel. In addition, chemical pollutants such as developer and fixer are currently required to process film and must be treated as hazardous materials. Rinse water for film processors stands at risk for becoming controlled as well.

For these reasons, ultrasonic inspection (UT) methods can be used to both decrease the construction costs while increasing inspection reliability. Use of ultrasonic technology to perform non-destructive examinations and certifications would reduce the need for safety precautions for radiography, and provide a more user-friendly tool (smaller, lighter weight, more portable) conducive to the conditions aboard an almost fully outfitted aircraft carrier. The objective of this project is to develop and implement ultrasonic inspection (UT) procedures and acceptance criteria as an alternative to radiographic inspection as required by the current specification for naval piping, pressure vessel and machinery welds. This project will concentrate on selected materials and weld geometries to encompass the largest percentage of welds.

Payoff

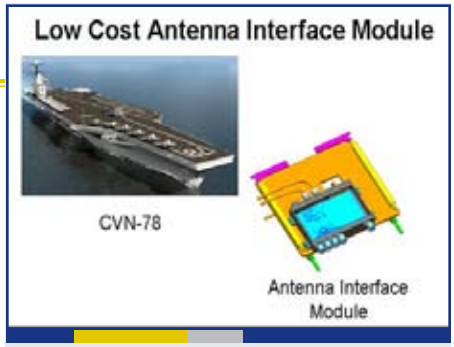
As a result of the reduced rejection rate of vendors' submitted welding procedures, The new construction cost savings in labor reductions and material processing is estimated at $1.5M per hull. Overhaul cost savings are estimated at $0.5M per hull. In addition, an estimated $50K per year would be saved in RT- related material costs. This estimate does not include cost / schedule issues resulting from RT disruption to other work, RT safety and environmental cost / concerns, other savings over the life of the ship (maintenance, refueling, shipalts, etc.), or savings to other shipbuilding programs (submarines, etc.).

Implementation

The development of UT procedures to replace RT procedures requires approval from NAVSEA and changes in Tech Pub. 278, which currently requires the use of RT on the applications targeted for this project. The scope of this ManTech project is to determine methods to develop these UT procedures and transfer them to Northrop Grumman Shipbuilding - Newport News. The timeframe for this project is currently estimated to be 24 months.

Use of SiC Technology Results in Size - Cost Reduction for Antenna Interface Module

S2255 — Low Cost Electronic Warfare Antenna Interface Module



Objective

The Low Cost Antenna Interface Module (AIM) for Electronic Warfare (EW) Systems project will leverage advancements in silicon carbide (SiC) technology to develop a SiC-based Microwave Monolithic Integrated Circuit (MMIC) to produce a low cost Antenna Interface Module. The focus of this project is to improve the existing hardware and simplify the overall architecture of the current Multifunction Electronic Warfare (MFEW) system. This project will create an architecture that will combine two multi-chip discrete components used in the MFEW system to produce a single Integrated Module Assembly (IMA) with SiC based MMIC technology. Silicon carbide, a wide band gap semiconductor material, enables higher RF power handling capability compared to traditional discrete components used in the present AIM design. The new AIM will significantly reduce cost and will improve RF performance for the Surface Electronic Warfare Improvement Program (SEWIP) Block 2 program.

Payoff

The main benefits of this project are reductions in size, weight, and manufacturing costs with improved RF performance for implementation to the SEWIP Block 2 program. By utilizing SiC technology to combine two assemblies into a single Integrated Module Assembly (IMA), it is anticipated that there will be a 50% reduction in cost and a 50% reduction in size compared to the existing AIM. The developed AIM will also be able to meet the high input power requirement over a wide bandwidth and reduce the front end Noise Figure (NF) by 2dB. The higher thermal conductivity and high operating temperature of SiC result in a RF power handling capability that is 3 to 4 times that of the current AIM components. This project will culminate in a proven new architecture providing significant reductions in cost and size.

Implementation

The target platform for the Low Cost Antenna Interface Module project is the CVN 78 Class aircraft carrier with the developed manufacturing technology implemented into the PEO-IWS SEWIP Block 2 program. One of the goals of this project is to have the final Antenna Interface Modules developed under this project included in the Design Verification Testing of the new EW system in mid- 2011. The first Low Rate Initial Production (LRIP) AIM systems are targeted for delivery to the CVN 78 Class program in late 2013. The SiC MMIC technology developed under this project will directly benefit other Electronic Warfare applications such as the DDG 1000, the EA-18G, and the F-35 Joint Strike Fighter. It may also benefit other surface and airborne radar applications that require high RF power handling capability.

PERIOD OF PERFORMANCE:

November 2008 to May 2011

PLATFORM:

CVN 78 Class

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EMPF

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STAKEHOLDER:

PMS 378

TOTAL MANTECH INVESTMENT:

$3,945,000

Laser Ablation Paint Removal Process to Reduce Cost Compared to Existing Paint Removal Methods

PERIOD OF PERFORMANCE:

March 2009 to September 2010

PLATFORM:

CVN 68 Class / Carriers

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements - Metals

CENTER OF EXCELLENCE:

NMC

POINT OF CONTACT:

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STAKEHOLDER:

SEA 04XC, PMS 312, and PMS 378

TOTAL MANTECH INVESTMENT:

$572,000

S2265 — Naval Application of Laser Ablation Paint Removal Technology

Objective

Removal of protective paints is required during in-service inspection, maintenance, and repair of Navy ships. Current paint removal methods are labor intensive and/or generate significant amounts of secondary waste, such as used grit, sanding disks and spent chemicals. The recovery and disposal of secondary waste adds tremendous cost and environmental impact to paint removal operations.

Laser ablation technology has been demonstrated to be effective at removing paint without generating secondary waste. This project will investigate commercially available, state-of-the-art lasers to identify a laser ablation process with reduced overall cost and comparable ease of use / removal rate to existing removal methods. The project will focus on shipboard paint removal applications within the interior spaces of Nimitz (CVN 68) Class Aircraft Carriers. The team also will discuss opportunities to leverage this technology on other platforms such as the VIRGINIA Class submarine (VCS).

Payoff

The potential benefits of this project include reduced life-cycle maintenance costs and environmental impact due to the elimination of secondary waste associated with paint removal operations. Previous DOD projects have demonstrated cost savings of between 10% and 95% for laser ablation paint removal compared to existing methods.

Implementation

The results of this project will be incorporated into the CVN 68 Class carrier maintenance procedures as an alternate surface preparation method and will be implemented at Northrop Grumman Shipbuilding - Newport News and Norfolk Naval Shipyard in the 2nd Qtr FY12.

DDG 1000 Projects
Table of Contents

NAVY MANTECH
Manufacturing Technology Program

DDG 1000 Projects

Alternative Materials and Application Procedures Reduce Hull Treatment Costs

PERIOD OF PERFORMANCE:

November 2006 to December 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements - Metals

CENTER OF EXCELLENCE:

NMC

POINT OF CONTACT:

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$3,812,000

S1081 — DDG 1000: Advanced Bonding Methods for Steel Structures Phase 2

Objective

The DDG 1000 has delivery requirements that necessitate the use of a Hull Treatment (HT) system be applied to portions of the underwater hull and waterline area. While this baseline treatment technology has been routinely applied to select Navy vessels, it is time consuming and labor intensive, and the current application procedure may be excessive for the DDG 1000 program. The objective of this project is to reduce the cost for procurement, installation, repair, and decommissioning of hull treatment on DDG 1000. The project is evaluating various aspects of the hull treatment system, including alternative anti-corrosive paints and adhesives, efficient manufacturing methods of system components, removal of lead from the system, materials / processes to improve installation, and identification / verification of a means to improve the system's durability.

Payoff

The total expected cost reduction per hull from implementing the results of this project is $3.5M. The breakdown of cost reduction includes: a procurement cost reduction of $790K per hull; an overall reduction in installation cost of $1,741K per hull; a repair cost reduction of $670K per hull; a repair cost reduction of $670K per hull, and decommissioning cost reduction of $350K per hull.

Implementation

Recommendations for each effort along with supporting technical data will be submitted for PMS 500 acceptance. In order to permit implementation, the recommendations will need to be incorporated into the hull treatment design and corresponding installation process instruction.

Hybrid Laser Welding Reduces Distortion and Cost

S2073 — Hybrid Laser Beam Welding

Objective

Hybrid laser arc welding is being developed as a means to increase affordability in ship construction. Under this project, hybrid welding processes were developed, tested, and demonstrated within the shipyard for welding thin steel panel structures. Specifically, butt and insert welds 0.5 inch thick and less were targeted by the technology. The target platform was DDG 1000; however, a successful process could be implemented to support the construction of other vessels, including LPD 17, CVN 78 Class, LHA 6, and CG(X). A Qualification Roadmap was developed, outlining the required welding qualification testing and evaluation that must be performed prior to welding on ship structures. Transition occurs when a shipyard-suitable hybrid process has been developed, demonstrated, and proven to be technically and economically feasible.

Payoff

Weld induced distortion will increase construction costs. No conventional arc or friction welding process available today can reduce distortion to the levels required to meet the design intention. The implementation of hybrid welding process for distortion control is an immediate need for production of thin steel Navy structures. Reduction in weld-related distortion rework due to reduction in heat input will result in estimated cost savings of $1.65M-$2.76M per DDG 1000. Hybrid welding will produce at least 4 times less weld distortion and heat input than conventional welding and will increase productivity by 13 to 190% depending on the application. This process will also reduce weigh-in filler metal volume by 400 to 700%. The reduced process emissions, and use of shared laser source to service butt welding and stiffener welding stations could triple the Return on Investment (ROI). Shipyard payback in one ship is estimated. This technology will impact applications aboard DDG 1000, as well as current and future Navy designs such as LPD 17, LHA 6, CVN 78 Class, and CG(X).

Implementation

Implementation of hybrid laser arc welding technology requires the following major project objectives be met: (1) qualifiable welds meet NAVSEA T9074-AQ-GIB-010/248 and ABS-NVR standards, (2) applicable in the current shipyard production environment, (3) reduced welding heat input and distortion, and (4) cost effective for reducing distortion costs. To date, it has been shown that 0.197 inch thick ABS/DH36 steel can be qualified to the aforementioned standards. Work in 2009 progressed towards the qualification of 0.5 inch thick HSLA-80.

Despite the technical successes and potential cost savings from hybrid laser arc welding, neither DDG 1000 shipyard has been able to allocate the capital necessary to purchase a system. While payback on the system will be less than one ship, there are uncertainties with current shipyard costs, and future ship contracts that must be addressed before investments are made. Applied Research Laboratory, Penn State has recently generated a strategic plan for implementation of hybrid laser arc welding at a shipyard that describes ways in which to overcome the hurdle of capital equipment acquisition.

PERIOD OF PERFORMANCE:

January 2005 to
September 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Distortion Reduction

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$2,198,000

Enhancements Offer Opportunities to Reduce Advanced Gun Systems Cost

PERIOD OF PERFORMANCE:

March 2009 to September 2010

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$942,000

S2132-2 — Low Cost Pallet Systems Phase 2

Objective

The DDG 1000 will be equipped with two Advanced Gun Systems (AGS). The EX-100 Advanced Gun System (AGS) pallet is used to package, handle, store and transport the long-range attack projectile munitions and charges through the logistic channels and within the AGS magazine in the DDG 1000 hull. The primary objective of the project is to reduce manufacturing cost and system weight of the AGS pallet assembly by 20% without compromising system performance.

Payoff

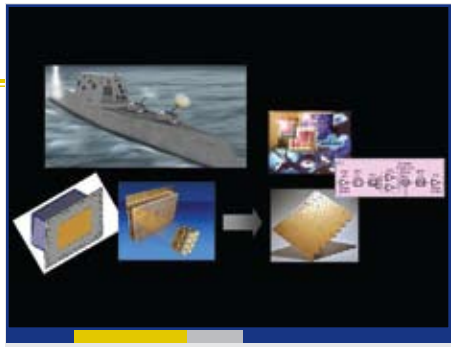
As a result of this effort, a 20% reduction in manufacturing cost will provide a $5.5M per hull savings and a reduction in system weight that will improve safety and survivability functions of the AGS pallet system.

Implementation

The Navy Metalworking Center (NMC) will optimize the manufacturing approaches developed during Phase 1, using Friction Stir Welding (FSW) and advanced machining and casting techniques to produce a prototype AGS pallet system that will be evaluated by the Integrated Project Team, including BAE Systems, the project prime integrator. A Technical Data Package of proven manufacturing improvements and cost reductions will be delivered to BAE Systems and NAVSEA PEO IWS 3C for implementation into the Low-Rate Initial Production builds of the AGS Pallet System early in 2011.

System-On-Chip Technology Produces Low Cost, Lightweight T/R Modules for Phased Array

A2147 — SiGe-Based System-On-Chip Low Cost / Weight Phased Array Antennas Phase A & B



Objective

This project will demonstrate three phased array antennas—receive, transmit, and combined transmit / receive (T/R)—for development. Boeing is providing the multi-beam Ku-band Communications Data Link (CDL) Phased Array Antenna (PAA) system to DDG 1000. These antennas will be designed for operation in the Ku-band which is suitable in both surface and airborne applications. For several years, Boeing has been doing research into new technologies that promise a breakthrough in phased array antenna cost, with significant improvements in size and weight. This work has helped prove feasibility of many necessary technology building blocks, but the building blocks have not yet been integrated into a comprehensive demonstration. The primary new technologies involve the use of flip-chip and chip-on-board interconnect technologies to replace current wire-bonding and multi-chip-module technologies and the development of a highly integrated system-on-chip (SOC) using silicon-germanium (SiGe) process technology to replace current gallium-arsenide (GaAs)-based Microwave Monolithic Integrated Circuit (MMIC) chipsets.

Payoff

The main benefit of this project is to provide smaller, lighter T/R modules using a system-on-chip technology that can also reduce cost due to integration savings. A cost avoidance of 50-65% and a size and weight reduction of 15-25% compared to current phased array antenna technology can be achieved using Boeing's chip-on-board approach based on the use of GaAs technology. The use of SiGe technology can further reduce semiconductor chip-set costs by up to 90%. In addition, the chip-on-board technology currently in development at Boeing is limited to ~15-20 GHz due to the lattice spacing requirements and the size of GaAs chips necessary to perform the module functions. SiGe has the potential to reduce the chipset footprint, thus extending the practical frequency range for this architecture to 40 GHz or beyond. Cost avoidance starts at $600K per ship set for the DDG 1000. This reduction is obtainable by reducing the chipset die element parts such as RF distribution, array system components, element assembly, and test labor.

Implementation

In Phase 2 of this project, Production Readiness Phase, the technologies developed and demonstrated in Phase 1 will be tooled up and made ready for DDG 1000 production insertion by the Boeing DDG 1000 program.

The technologies developed as a result of this work will have potentially wide applicability to Navy programs. Based on the current generation of technology, the following applications can be addressed: multi-chip module (MCM), brick-style antenna packaging, and MMIC chipsets. These basic proven technologies can be adapted to meet a diverse range of antenna requirements. The basic packaging architecture can also be adapted, depending on number of elements, number of beams, radio frequency band, and many other application-specific requirements. The underlying package design and manufacturing approach as well as the underlying SiGe technology design and fabrication methods will be proven and common between applications.

PERIOD OF PERFORMANCE:

July 2006 to May 2010

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EMPF

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$2,024,000

Affordable Stiffener Manufacturing Methods Resulted in Significant Cost Savings for DDG 1000

PERIOD OF PERFORMANCE:

July 2007 to September 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Composites

CENTER OF EXCELLENCE:

CMTC

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$1,988,000

S2149 — Cost-Effective, Integrated Stiffener Manufacturing for DDG 1000 Integrated Deckhouse and Hangar (IDHD)

Objective

The DDG 1000 requires a helicopter hangar with extended, unsupported spans that result in demanding stiffness requirements for the materials used in the hangar. The hangar must also support two guns and associated equipment on the aft corners of the structure. A complex cross-section, carbon fiber / vinyl ester composite design was shown to meet the design requirements of the DDG 1000 hangar; however, these materials have only recently been considered for Navy shipbuilding applications. The size, laminate complexity, and thickness of the beams, and the fact that these beams intersect complex composite-to-composite and composite-to-steel joints, present manufacturing challenges not dealt with in the DDG 1000 program or previous composite shipbuilding programs.

The objective of this project was to develop and demonstrate methods for manufacturing large thick cross-sectioned (>1.5") composite stiffeners and stiffener joints. Vacuum-Assisted Resin Transfer Molding (VARTM) approaches for constructing the stiffeners and joints were developed and analyzed using Liquid Injection Molding Simulation (LIMS) and Polyworx software tools for infusion set-up optimization. Test articles fabricated were evaluated using non-destructive inspection and destructive testing to qualify results. The final portion of the project produced demonstration articles of both individual stiffeners and a representative full-scale article which incorporated both stiffener and associated joints.

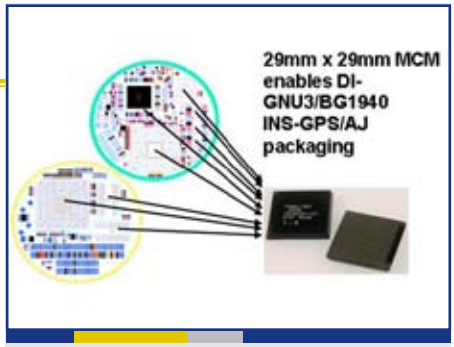
Payoff

The project resulted in a cost-effective manufacturing approach for the DDG 1000 composite helo hangar stiffeners. The principal benefit was the development of a predictable and repeatable process that reduces the defect rate associated with large thick cross-sectioned composite parts. The use of composites on the DDG 1000 and future surface combatants will ensure mission capability, increased performance resulting from lighter weight, and a reduction in life-cycle costs. Therefore, cost-effective composite manufacturing techniques represent a significant benefit to the Navy. The resultant beam configuration and chosen production method performed during the project enabled Northrop Grumman Shipbuilding (NGSB) to significantly reduce rework and the associated schedule impacts that could occur during production. A total cost avoidance of approximately 30% of the helo hangar stiffener fabrication and repair cost was estimated as a result of this effort. NGSB estimated that at least one complete box beam would be scrapped during the initial production processes when trying to manufacture these parts without the lessons learned from this project.

Implementation

Transition was initiated in July 2009 after the test data had been received, and evaluated, and the manufacturing processes, and approach developed during the project were transitioned into work packages that will be used by NGSB to fabricate hangar box beams for DDG 1000. Project exit criteria include the determination of a hangar box beam fabrication approach, the efficient production of a representative full-scale article, and the successful non-destructive inspection of that article.

Design of Electronics for Guidance Units Improved



S2153 — High-g Packaging and Miniaturization of Electronics for Deeply Integrated Inertial Guidance Units

Objective

Honeywell's BG1930G deeply integrated Inertial Navigation System - Global Positioning System with Anti-Jam capability (INS-GPS/AJ) product has been baselined as the primary production navigation, flight control, and mission computer for Lockheed Martin's Long Range Land Attack Projectile (LRLAP) utilized in conjunction with the Navy's Advanced Gun System (AGS) for the DDG 1000 destroyer. This project studied the packaging of the BG1930G or similar product to assess its survivability to different gun launch environments and suggest improvements to the design. Another aspect of this project was the application of multi-chip module (MCM) technology to the discrete semiconductor approach used in the BG1930G. System-On-a-Chip (SOC) technology is used for developing the next generation mission processor. The MCM approach combined the mission processor, inertial sensor assembly interface, digital anti-jam functions, user serial interface, and corresponding electronics functions onto a single substrate. Development and incorporation of MCM technology effectively eliminated an entire printed wiring board from the product baseline.

Payoff

In the past, projectiles and components have been designed to a specification of "survive x-thousand G's", which has resulted in program extensions and overruns, and advances in modeling and simulation have proven this method of specification insufficient. An improved method of specifying design criteria is to specify a representative load curve (with margin) that includes the dynamics of the system. This project applied this design methodology to the simulation of components for the Deeply Integrated Navigation and Guidance Unit (DIGNU) to determine survivability to gun launch and also made recommendations for design improvements. This project also sought to determine the survivability of some MEMS sensors to the high shock of gun launch. These recommendations would improve survivability. The application of SOC and MCM technologies reduced INS/GPS unit cost and the INS/GPS size to fit more DOD weapon applications. The SOC technology provided a greater than 2x improvement over the present processor platform, and consumed less power while handling a wider temperature range. The use of MCM technology will eliminate an entire printed wiring board from the product baseline and enable the achievement of aggressive Average Unit Production Pricing objectives, producibility, reliability, weight, and volume objectives mandated by LRLAP and other Joint Navy / USAF program applications.

Implementation

The effort detailed in this project was independent of an insertion target platform. The simulations performed, while dependent on the details of the individual IMU being modeled, formed the basis for a methodology for improving the shock resistance of MEMS sensors and electronics modules for other precision guided munitions. At the conclusion of this ManTech effort, the memory system, processors and custom interface functions were successfully integrated into a single 29mm x 29 mm package, and both its functionality and suitability for gun-hard applications, such as the BG1930 and BG1940 family in INS-GPS/AJ products will have been confirmed. At this point, the Technology Readiness Level (TRL) of the SOC will be TRL 6—suitable for integration into the LRLAP used on DDG 1000.

PERIOD OF PERFORMANCE:

September 2006 to December 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EMPF

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STAKEHOLDER:

PEO (IWS)

TOTAL MANTECH INVESTMENT:

$2,875,000

Manufacturing Techniques for Very Large Radomes for DDG 1000 Could Reduce Cost by $1.6M Per Ship

PERIOD OF PERFORMANCE:

January 2009 to April 2010

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Nonmetallics

CENTER OF EXCELLENCE:

CMTC and iMAST

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$1,146,000

S2159-A -2— Low Cost Manufacturing Technology for Very Large Format Low Observable DDG 1000 Radomes Phase 2

Objective

Future ship communications and radar systems require very large scale low observable (LO) radomes for mission success. Consequently, future ship radomes require large scale Frequency Selective Surface (FSS) structures and laminate materials. The large size of DDG 1000 proposed installations can require seams, grounding, embedded treatments, and anti-ice grids. To achieve the desired radome radio frequency (RF) performance levels, laminate defects must be minimized and laminate thickness must be maintained within thousandths of an inch over the entire radome surface area. The cost of these radomes can exceed a half million dollars each and has become a significant portion of the DDG 1000 communications and radar system cost. In order to reduce radome acquisition costs, production radome fabrication yields must be pushed to nearly 100 percent. This aggressive fabrication goal may be accomplished with hand lay-up autoclave cure manufacturing methods that integrate tailorable ply kits and optimized debulk cycles with both geometric and ultrasonic in-process non-destructive inspection. Robust repair protocols must also be developed to meet the necessary yields. The objective of this two phase ManTech project is to develop and demonstrate a low cost manufacturing method that integrates tailorable ply kits and optimized debulk cycles with in-process non-destructive inspection (both geometric and ultrasonic) and robust repair protocols to ensure very high yield DDG 1000 deckhouse EHF and X/Ka-band radomes. In Phase 1, innovative manufacturing methods and in-process non-destructive inspection (NDI) techniques were developed and demonstrated using scaled flat panels that were representative of the EHF radome design. Phase 1 also demonstrated multiple repair procedures on scaled flat panels, representative of the EHF, IFF, and SPY-3 radomes. In Phase 2, the robustness of the proposed manufacturing, NDI, and repair protocol developed in Phase 1 will be assessed by fabricating a 9'x 13' VSR-style radome.

Payoff

The estimated cost of the radomes for DDG 1000 exceeds $8M per ship. The proposed manufacturing techniques will improve yields by 20%, realizing a cost avoidance of $1.6M per ship. Successful execution of this plan will help improve quality control for the fabrication of the Very Large, Low Observable Multi-band Radomes. Assuming a Navy buy of 3 DDG 1000 ship sets, the Return on Investment (ROI) for this project will be 1.84. The ROI will increase as these radomes and, subsequently, the radome manufacturing technology is implemented on LCS, CG(X), and CVN platforms.

Implementation

This project has developed manufacturing protocols which will transition to the ZUMWALT class ships in 2008-10. Major project tasks were completed in the third quarter of 2008. A successful Phase 1 design review in June 2008 was held where the protocols and program accomplishments were presented to the aperture and ship community. Phase 2 was recommended. The DDG 1000 deckhouse internal working group will be used to facilitate the technology transition. In the case of VSR, EHF, CEC 2, IFF, and SPY-3 radomes, Raytheon APC is either the design or manufacturing agent. This manufacturing technology will directly impact the first two ship deliveries. This manufacturing technology will be implemented continually throughout the project as the technology progresses. This project is a joint effort with the Institute for Manufacturing and Sustainment Technologies (iMAST), see project S2168.

Manufacturing Protocols Reduce the Cost of Large DDG 1000 Radomes

S2168 — Low Cost Manufacturing Technology for Very Large Format Low Observable DDG 1000 Radomes

Objective

Future ship communications and radar systems require very large scale low observable (LO) radomes for mission success. The cost of these radomes can exceed a half million dollars each, which is a significant portion of the DDG 1000 communications and radar system cost. The objective of this project is to reduce radome acquisition costs and maintain delivery schedules via maintaining production radome fabrication yields near 100 percent. Furthermore, the project objective is to develop a hand lay-up autoclave cure manufacturing method that integrates tailorable ply kits and optimized debulk cycles with in-process non-destructive inspection (NDI) and robust repair protocols. Applied Research Laboratory (ARL) Penn State leads the in-process nondestructive inspection (NDI) effort and has successfully demonstrated the integrated (ultrasound and laser tracking) NDI technology on evaluation and production radomes.

Payoff

Improved manufacturing technology will enable reduced cost and improved sustainability for very large low observable radomes. These advanced architecture radomes provide signature reduction critical to the future ship mission while increasing survivability. The radio frequency performance of these composite radomes requires both a defect-free laminate with a precision-controlled thickness fabrication methodology with applicability to all future surface ships implementing digital radar arrays. The estimated cost of the radomes for DDG 1000 exceeds $8M per ship. The manufacturing techniques being developed in this project will improve yields by 20%, realizing a cost avoidance of $1.6M per ship. This results in a total savings for DDG 1000 (three ships) of approximately $5M with future CG(X) (seven ships) and CVN ships benefit at this level and higher.

Implementation

This program has developed manufacturing protocols which will transition to the ZUMWALT class ships in 2009-2010. Major Phase 1 program tasks were completed in the third quarter of 2008. A successful Phase I design review in June 2008 was held where the protocols and program accomplishments were presented to the aperture and ship community. Phase 2 was strongly recommended and was funded in March 2009. The DDG 1000 deckhouse internal working group will be used to facilitate the technology transition. In the case of EHF TxRx, CEC 2, IFF, SPY-3 and VSR radomes, Raytheon APC is either the design or manufacturing agent. This manufacturing technology will directly impact the first two ship deliveries. The integrated NDI technology has been demonstrated on a production EHF radome in a manufacturing facility. This project is a joint effort with Composite Manufacturing Technology Center (CMTC), see project S2159-A-2.

Note: This project is led by the Composite Manufacturing Technology Center (CMTC), with a portion of the work performed by the Institute for Manufacturing and Sustainment Technologies (iMAST).

PERIOD OF PERFORMANCE:

October 2006 to April 2010

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements -Nonmetallics

CENTER OF EXCELLENCE:

CMTC and iMAST

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$655,000

Mechanized Weld Grinding on DDG 1000 Increases Productivity and Reduces Production Costs and Workforce Hazards

S2172 — DDG 1000 Weld Seam Facing

PERIOD OF PERFORMANCE:

June 2007 to January 2010

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$1,212,000

Objective

DDG 1000 Class ships have a substantial requirement for hull surface fairness both above and below the waterline. The requirement is much more stringent than for past ship construction projects. Butt welding exterior ship hull and deck panels produces a weld protrusion that exceeds DDG 1000 fairness requirements. As a result, approximately 23,000 feet of weld reinforcement must be hand ground flush. Manual weld removal is slow, which increases shipbuilding costs, and the repetitive nature of hand grinding causes frequent injuries and costly medical expenses. This Navy Metalworking Center (NMC) project has developed a portable tool that automatically faces the weld reinforcement, substantially reducing the amount of hand grinding and associated injury claims, labor costs and production costs.

Payoff

The tools are expected to achieve a cost reduction of $2.77M for the DDG 1000 Program based on three ships. Average reinforcement removal rate was verified to be well in excess of 40 feet per hour compared to the present rate of 3 feet per hour. The tool can operate in flat, vertical, horizontal, and overhead orientations. The tool will also be used for the removal of lifting lugs on DDG 51 and up to 14,000 feet of weld protrusions on the LHA flight deck. If the tool can be adapted to perform back gouging of weld joints, Bath Iron Works (BIW) and Northrop Grumman Shipbuilding – Gulf Coast (NGSB-GC) have identified additional savings of $2.4M based on DDG 1000, LHA 6, LPD 17, and the Maritime Security Cutter.

Implementation

The final preproduction tools were delivered to BIW and NGSB-GC in June 2009. Currently the tools have been implemented in the construction of DDG 51 at BIW and are awaiting implementation on the flight deck of an LHA at NGSB-GC. The use of the preproduction tools will enable the shipyards to begin to take advantage of their benefits, identify potential tool enhancements for future production tool acquisitions and identify other processes that can leverage this technology. Currently, a modified version of the tools is being considered for back gouging at both BIW and NGSB-GC.

Alternate Mounting Methods Reduce Outfitting Time by 20% to 50%

S2182 — Alternate Mounting Methods for Lightweight Structures

Objective

The objective of this project was to identify, validate, and qualify alternate methods for mounting lightweight (i.e., less than 40 lbs) items onboard US Navy ships. The conventional, labor-intensive method of welding, riveting and bolting adds unwanted cost, time, and weight in new ship construction and repair activities. Some commercially available products show promise to reduce cycle time for installation of lightweight outfitting items via alternate mounting methods, with the project team evaluating 3M's Very High Bond (VHB) adhesive tape family. The NAVSEA-approved preliminary test results showed promise for these types of technologies, as representative lightweight items were tested and passed a thorough set of NAVSEA requirements. The project determined the most suitable commercially available bonding material using a NAVSEA-approved test plan that evaluated the bonding material's suitability for use onboard Navy vessels, specifically the DDG 1000 platform, though the 3M VHB tape has use across a wide range of platforms in both new construction and repair applications.. Bath Iron Works (BIW) teamed with Northrop Grumman Shipbuilding - Gulf Coast (NGSB-GC) to test one group of outfitting items weighing less than 20 pounds (e.g.,category I), with varying, purpose, shape, and location. The project team conducted a technology review and down-selected the most feasible adhesive that would meet operational requirements as determined by the cognizant NAVSEA technical authorities, ultimately subjecting this VHB technology to rigorous testing and evaluation to determine the feasibility of shipboard use.

Payoff

With dozens of unique outfitting items weighing less than 20 pounds currently onboard Navy ships, significant cost avoidances can be realized through the use VHB-type adhesives. These articles total over 20,000 pieces per ship and include a wide variety of shipboard items such as bulletin boards, coat hooks, mirrors, electrical receptacles, wrench stowage, clock boxes, etc. The current installation methods involve welding, bolting, and riveting, a labor-intensive and time-consuming process where the average time to install these items using the current methods ranges from one to four hours and set-up time alone varies from 1.5 to 2.5 hours per shift. Adding to the installation costs is the required 100% quality assurance visual inspection of all welded attachments. This manufacturing technology initiative has the potential to reduce outfitting time by 20% to 50% for the approved items, resulting in cost avoidance on the order of $1.5M to $3M per ship for the DDG 1000 program. Findings from this project are applicable and benefit construction and repair activities across the broad spectrum of Navy platforms.

Implementation

The NAVSEA Technical Authorities are reviewing the project's test results. BIW is developing a NAVSEA-monitored at-sea trial period aboard a DDG 51 Class vessel and, upon receiving NAVSEA approval of shipboard testing, BIW plans to integrate VHB use at ship construction facilities in 2010. Results have been disseminated industry-wide and Navy Program Offices continue to evaluate VHB use for other Navy platforms.

PERIOD OF PERFORMANCE:

June 2007 to July 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Outfitting

CENTER OF EXCELLENCE:

CNST

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$729,000

Improved Metrology Results in Substantial Cost Reduction

PERIOD OF PERFORMANCE:

November 2007 to January 2010

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Distortion Reduction

CENTER OF EXCELLENCE:

CNST

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$975,000

S2183 — Hull Fairness and Accuracy Control

Objective

The Navy has increasingly emphasized the lowering of radar cross section on its surface combatant vessels to enhance combat survivability. As such, the shipyards that build these vessels will be held to more stringent requirements than previously seen, but traditional production processes pose challenges to achieving these ship design requirements. Special processes and procedures must be implemented to meet these requirements, which could cause shipbuilding costs to soar if conventional equipment and practices are employed. This ManTech project investigated three commercially available metrology systems: a laser tracking system multi-camera photogrammetry, and a laser scanning system, each identified, and piloted following a complex market analysis and down-select activity. The project team anticipates implementing the expanded use of metrology instrumentation during the shipbuilding process at Northrop Grumman Shipbuilding - Gulf Coast facilities (NGSB-GC). NGSB-GC investigated two areas, focusing on new technology / equipment / software and near-term training on existing systems. Hardware, software applications, and training requirements were identified based on shipyard production needs and program requirements, specifically for the DDG 1000 platform, though many of the evaluated metrology systems have capabilities applicable to multiple manufacturing production processes.

Payoff

This effort enabled the investigation of new technologies and software for use in NGSB-GC special processes and procedures, the utilization of which is estimated to reduce rework (and its associated cost) and improve cycle time, with an estimated $1M - $3M cost avoidance per DDG 1000 hull. Bath Iron Works (BIW) has participated in the Phase II activities, evaluating the metrology pilot results for potential BIW production use, focusing specifically on non-intrusive, seamless distortion measurement applications. Project results will not only facilitate the shipyard's ability to meet enhanced radar cross section requirements for the DDG 1000, but will improve many facets of accuracy control. The Navy is currently using one of the technologies investigated as its means to conduct combat system alignment procedures.

Implementation

Implementation activities are inherent to this project, which is providing NGSB-GC Accuracy Control (A/C) personnel the hands-on experience and training required for new equipment and software. As a result of the project's findings, NGSB-GC is purchasing a state-of-the-art laser tracking system for use in many facilities and manufacturing processes. NGSB-GC has identified and revised alignment and installation processes to support 'laser tracker' use, currently leasing this metrology system pending final purchase and implementation, expected in January 2010. Both NGSB-GC and BIW shipyards have identified production areas where these metrology systems could yield additional benefits.

Mechanized Welding to Result in Reduced Cost and Cycle Time for Large Marine Structures

S2194 — Weld Development of Large Marine Structures for Hull Integration

Objective

The Navy Joining Center (NJC) is participating in an integrated project team along with PMS 500, Bath Iron Works (BIW), Northrop Grumman Shipbuilding - Gulf Coast (NGSB-GC), Naval Surface Warfare Center - Carderock Division (NSWC-CD), and Robotic Technologies of Tennessee (RTT) to develop high productivity, cost effective, out-of-position, mechanized welding processes / procedures for large thick-section, high-strength steel structures for enhanced survivability for next generation surface combatants. The NJC objective is to develop and demonstrate welding procedures necessary to support the required productivity improvements. The technology will initially be implemented on DDG 1000. The welding technologies developed during this project are expected to have wider applications to other Navy ship systems, including thick high strength steel structures on CVN 78 Class and VIRGINIA Class submarines (VCS).

The goal of this project is to develop mobile, high productivity welding technology for large thick-section, high-strength steel structures for integration into the hull of the DDG 1000 next generation surface combatants. This goal will be accomplished by leveraging development activity from Navy ManTech Project S1054, "Manufacturing Large Marine Structures". Further development will investigate several processes to facilitate out-of-position erection welding. Robust welding procedures will be developed with the preferred processes, and the integration of weld mechanization to maximize first- time quality.

Payoff

The advancements resulting from this project are targeted to reduce welding labor hours and assure first-time quality. The result will be cost savings and reduced production schedules. A labor savings of $344K per ship is anticipated.

Implementation

The implementation plan is structured to satisfy the design and construction schedule requirements for the production of DDG 1000. In Phase 1 of the project, candidate welding processes were screened to identify the best combination of weld properties and operating characteristics. Procedures have been developed for the Flux Core Arc Welding (FCAW) and narrow-groove Gas Metal Arc Welding (GMAW) processes using 100-type consumables. In Phase 2 of the project, preferred process combinations that offer the highest productivity for erection welds will be optimized for robustness. This includes the development of process windows and models that can be used to automate each process to the maximum extent possible. Procedures will then be refined, qualified, demonstrated, and validated. The developed technology is to be completed for implementation on DDG 1001. The large structures are to be joined to the hull in early 2010.

PERIOD OF PERFORMANCE:

September 2007 to December 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements - Metals

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$908,000

Improved Manufacturability of Power Electronic Module Results in an Estimated Savings of $1.5M Per Ship

PERIOD OF PERFORMANCE:

May 2007 to September 2008

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EMPF

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$1,697,000

S2203 — Power Electronic Module Cost Out for the IFTP Program

Objective

The multi-mission DDG 1000 destroyer introduces a wide range of new technologies that will generate tangible breakthroughs in performance and affordability. Advances such as the integrated power system (IPS) provide continuous power throughout the ship allowing enhanced survivability by reducing the susceptibility to damage and increasing the ability to fight-through damage. This integrated fight through power (IFTP) is based on a modular power system building block or power electronics module (PEM) that can be connected in parallel or in series to support a wide range of horsepower. This project successfully investigated and implemented cost reduction opportunities for the PEM that will improve the affordability of the IFTP System. The proposed changes have been demonstrated to reduce the materials and assembly price of each system and produced four PEMs which substantially accelerated the manufacturing learning curve. These modules have been used to perform some full power testing and have validated that the design meets the performance requirements. By investigating and resolving anomalies sooner than could be done under normal manufacturing conditions, this project has reduced the risk of performance issues during the First Article manufacturing and test phases so delivery schedules were met.

Payoff

This effort has achieved the costing objectives without compromising on the product performance, quality, and time to manufacture. Material cost has been reduced by 15% while labor cost has been reduced by 50% resulting in an overall cost reduction of 23% per PEM. Improved manufacturability resulted in a 73% reduction in the touch labor required to build the second generation PEM. These improvements will result in a cost avoidance of approximately $1.5M per ship.

Implementation

The project completed in September 2008, in time for the Production Readiness Review of the PEM system for Bath Iron Works (BIW). The technology developed was successfully transitioned when the PEM manufacturing process and Brass Board testing demonstrated full compliance to the original design requirements. This redesigned second-generation PEM is the design that was supplied for the First Article Qualification testing for BIW. They are currently in production and have successfully paralleled 4 PEMs in a PCM1 cabinet during integration testing.

Reduced Distortion of Thin Structures Has Potential Savings of $1.5M Per DDG 1000

S2205 — Distortion Control for DDG 1000 Thin Structures

Objective

The problems of distortion due to thermal cutting and welding are well documented. These issues are a significant manufacturing problem for thin ship structures that are becoming an ever higher percentage of ship content. Distortion of thin panels makes it more difficult to fit and weld subsequent assemblies and units as well as to meet fairness and straightness requirements. The result is increased ship construction costs and schedule delays. Distortion also is a problem for complex new systems, including DDG 1000's z-frame antenna aperture foundations. The objective of this project is to reduce distortion of thin ship structures and z-frame antenna aperture foundations through improved dimensional control of cutting, welding, and handling operations as well as the introduction of best practices for tandem submerged arc butt welding and fabrication of ship structures and z-frame antenna foundations.

Payoff

Implementation of the technology developed during this project will reduce the construction costs for DDG 1000 Class ships. The cost of distortion for thin construction for DDG 1000 is estimated to be 150,000 labor hours per ship. This is equivalent to $7.5M in construction costs to the Navy. It is estimated that approximately 30,000 labor hours can be saved; this labor is valued at $1.5M per ship. Benefits will be applicable to future ship classes as well as the DDG 1000.

Implementation

The project plan is structured to support Northrop Grumman Shipbuilding - Gulf Coast in the implementation of technologies that reduce distortion for thin plate fabrication on their new panel line, and will develop new practices and technologies to reduce distortion for z-frame antenna aperture foundations, subassemblies, and units. The integrated project team's participation in the project supports results that will meet production requirements and lead to successful implementation. Complete technology transition is expected by late 2009.

PERIOD OF PERFORMANCE:

May 2008 to November 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Distortion Reduction

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$495,000

Hybrid Laser Arc Welding of HSLA-80 T-Beams Reduces Costs and Improve Quality of DDG 1000

PERIOD OF PERFORMANCE:

July 2007 to December 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,940,000

S2208 — Improved HSLA-80 T-Beams

Objective

T-Beam stiffeners are used extensively in ship construction for decks, bulkheads, shells, and other structural applications. As the need for weight and cost reduction grows, alternate production methods are being considered to improve beam quality, to weld thinner plate materials, and to minimize distortion and the cost and availability of beams for ship construction. The project objective is to determine optimum parameters for hybrid laser arc welding (HLAW) of HSLA-80 T-Beams that will reduce production and assembly costs as well as improve T-Beam quality for DDG 1000.

Payoff

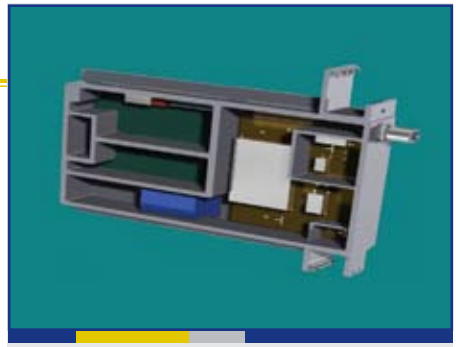
The hybrid laser arc welding process allows higher weld travel speeds and reduced distortion, which result in less rework and lower beam production costs. In addition, the improved beam quality provides better fit-up during shipyard construction, which reduces assembly costs. The higher travel speed and reduced distortion are expected to reduce T-beam fabrication costs by 45% and reduce ship construction costs by $647K.

Implementation

This project has developed a HLAW process that has been approved by the American Bureau of Shipping. The process will be implemented at American Tank and Fabricating Company to produce HLAW HSLA-80 T-beams for DDG 1000. The system is expected to be qualified and operational before the end of 2009. Other potential platforms that could benefit from this Navy Metalworking Center (NMC) project include the Littoral Combat Ship, which uses a variety of thin section materials including ASTM A710, a material very similar to HSLA-80.

Packaging Methodology Improves Affordability and Sustainability with SMT DREX Modules

S2211 — Digital Receiver and Exciter (DREX) Manufacturing Technology for Radars



Objective

To take advantage of digital beam forming and distributed architectures in the next generation of radars, the need for a large quantity of low cost digital receiver and exciter (DREX) assemblies has become a driving requirement. The main aim of the DREX project was to develop fabrication and assembly processes to support the development of low cost DREX assemblies at the sub-array and element level in a distributed architecture for S and X-Band radar applications. A report on the current REX designs and new DREX definitions was produced early in the project, and a detailed survey report compiled on the multiple COTS/MOTS surface mount technology (SMT) components in a DREX X-Band down converter. A key aspect of this project is the application of established design for manufacturability (DFM) techniques to the DREX design, incorporating SMT design features, and packaging approach. In addition, a detailed packaging study was performed on the DREX assembly. The most consequential output of the project was the reliability test results of a test vehicle that contained the significant features and package types of the DREX design.

Payoff

Receiver Exciter (REX) architectures utilize connectorized component packages with increased volume and weight and higher costs incurred for connectorized packages, cables, and manual assembly. With the development of DREX assemblies in this project, the cost, size, weight, and power (CSWAP) of the radar system was greatly reduced. The near-term goal was to reduce REX receiver hardware cost by more than 50%. This project examined ways of reducing CSWAP with SMT components on multilayer mixed substrate PWBs. MMIC based designs were also evaluated to even further reduce size and costs. The most important benefit of this project was the ability to support the multiple simultaneous missions requiring multiple waveforms, high dynamic range, and wide bandwidths seen in the continually changing and demanding world of radar processing.

Implementation

The target platform for the DREX assemblies is the DDG 1000 X-Band REX. As part of this project, other target platforms were reviewed for potential additional implementation. A major goal of this project was to demonstrate the DREX X-Band down-converter module to achieve a TRL 4-5 rating. A follow-on project must occur for the DREX module developed under this project to directly replace the existing X-Band REX hardware. The follow-on work will update the hardware to the current REX form and fit. The DREX X-Band down-converter is intended for insertion onto the third ship of the DDG platform.

PERIOD OF PERFORMANCE:

August 2007 to July 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EMPF

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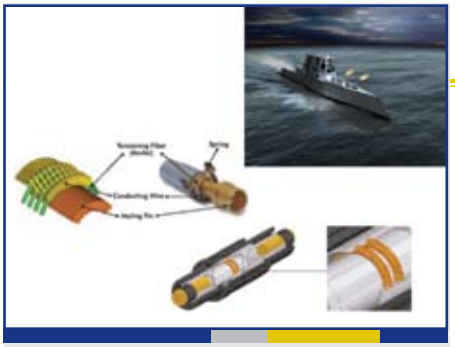
STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$1,802,000

Lower Interconnection Costs Yield Savings of $1.8M Per Ship



PERIOD OF PERFORMANCE:

July 2007 to March 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EMPF

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$986,000

S2212 — High-Power, High-Density Interconnection Program

Objective

The objective of this project was to develop, fabricate, assemble, demonstrate, and perform limited qualification testing on the next generation power connectors using emerging contact technologies. These connectors offer significant performance benefits resulting in reduced cost as well as higher reliability. The new technology contacts allow significantly higher currents (40-400% increase) to be passed over a comparable size traditional electrical contact. For example, a commonly used #20 AWG M39029 contact can carry 7.5 Amps while a common #20 AWG wire is rated for 11 Amps. These new contact technologies are capable of carrying more than 17 Amps per comparable #20AWG contact. This higher current density will facilitate significant cost reductions in the cost of power transmission by reducing the overall number of power cables as well as reducing cost of the remaining cables.

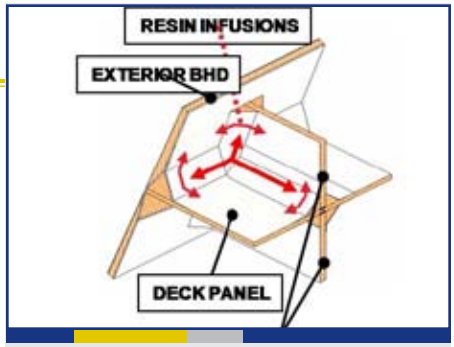
Payoff

This project achieved lower interconnection costs by incorporating emerging contact technologies into commonly used MIL SPEC configurations and testing them to ensure they can meet the advertised increased power densities. Cost reduction is strongly related to power density, and interconnection hardware, such as connectors, cables, and even small Z-Axis sockets, can be significant contributors to the overall cost of a system. The cost savings resulting from introducing this new technology into circular and rectangular Mil-Spec connectors was estimated at $1.8M per ship. These savings resulted from the anticipated reduction in power cable assemblies and the reduction in cost associated with being able to utilize smaller, less costly connectors.

Implementation

This project exploited several paths for inserting the resultant technology and knowledge into the DDG 1000 program. The primary path followed was the insertion into specific connector applications. Raytheon's IDS Interconnection Design groups regularly develop application specific connectors. Typically, application specific connectors are required for a high density packaging area such as an Antenna TRIMM Assembly. This assembly was the building block of phased array antennas and therefore has a high volume part. Critical design attributes of TRIMM connectors are low cost, low weight, high reliability, and low insertion force (to facilitate blind mating). The results of this project matched the needed design attributes and will be leveraged for insertion into next generation TRIMM Assembly connectors. A secondary insertion path was integrating the Z-Axis interposer into high density advanced packaging power supply designs. Next Generation Power Supplies utilizing Wide Band Gap (WBG) technology will have significantly higher power densities and require novel power transmission solutions such as those developed in this project. These assemblies are expected to achieve an 8:1 increase in power density in the very near future. The broadest impact will be through the creation of industry-level circular and rectangular connector specifications through an organization such as Society of Automotive Engineers (SAE). Raytheon IDS (Integrated Defense Systems) Engineering regularly attended SAE International Aerospace meetings and was actively involved in the Connector Technical Standards committee. This committee was responsible for the creation of new industry-wide connector specifications and review of changes to existing SAE connector specification.

Preforms Offer Cost and Time Savings for DDG 1000



S2261 — DDG 1000 Affordable Joint Fabrication Techniques for Reduced Critical Flaws

Objective

DDG 1000 composite deckhouse components are fabricated with carbon fiber reinforcement, stacked in various configurations to achieve final part dimensions and thickness requirements. Current fabrication techniques require each individual ply of carbon fiber to be trimmed from a 50 inch wide roll of reinforcement material. Set-up and staging for cutting activities is time consuming and labor intensive. Cutting activities also frequently require multiple transfer steps. Accuracy control of trimming is challenging over long joint spans. Ply placement in complex lay-up configurations is difficult and time consuming. Quality support to verify ply count, configuration, and orientation also adds time to the assembly process. Repair and rework of defective joints is currently 60% of the total rework allowance for the entire fabrication and assembly of the DDG 1000 deckhouse. Preforms may lessen or prevent these flaws; however, what is also needed is a better analytical correlation between flaws detected by ultrasonic testing and the structural impact of that flaw on the joint. A combined program addressing the material lay-up and flaw criticality is needed to provide a more affordable composite joint for the DDG 1000 Program.

The project objective is to develop and demonstrate the viability of preform technologies to reduce labor and lay-up induced flaws associated with DDG 1000 deckhouse and helo hangar joint fabrication activities. Work performed under the ONR Composite High Speed Vessel (CHSV) program demonstrated the labor saving benefits of preform technologies and gives confidence in the application on DDG 1000. Expanding the capability of existing flaw modeling tools and developing a handbook that better correlates defects with their structural impact will also aid in reducing the cost of composite joints by decreasing rework for non-critical flaws and would aid DDG 1000 Class ships.

Payoff

The use of preforms offers potential cost and time savings to current joint lay-up processes and will reduce variability at ply termination points, and will provide a more repeatable fabrication methodology for composite joints. By substituting individual ply placements with preforms for the applicable joints, this project could reduce the lay-up costs for over 65% of deckhouse joints. Additional savings could be seen on the helicopter hangar stiffener joints with similar lay-up configurations estimated to affect another 10% of deck joint. The manufacturing improvements associated with this effort could impact additional ship platforms such as LPD 17, CG (X), or future platforms utilizing composites.

Implementation

Northrop Grumman Shipbuilding (NGS) has performed structural testing to verify that project specimens meet composite flaw inspection criteria, including flaw size and distribution. Preform specifications were used to fabricate components and provide quality assurance criteria. A test plan was developed to validate coupon and component level test specimens. Test resulsts will be analyzed to determine any performance improvements from the use of preforms, and a critical flaw mapping handbook will be developed to better define areas that require repair. Upon completion, preforms will be procured in accordance with the specifications developed during this project. NGS Production Team Work Instructions and Workbook Packages will be modified as required to incorporate the use of preforms in the fabrication activities of deckhouse and helicopter hangar joints for DDG 1000.

PERIOD OF PERFORMANCE:

November 2008 to December 2009

PLATFORM:

DDG 1000

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements - Composites

CENTER OF EXCELLENCE:

CMTC

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STAKEHOLDER:

PMS 500

TOTAL MANTECH INVESTMENT:

$1,834,000

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LCS Projects
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LCS Projects

Friction Stir Welding Offers Advantages in LCS Construction

PERIOD OF PERFORMANCE:

August 2007 to January 2010

PLATFORM:

LCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 501

TOTAL MANTECH INVESTMENT:

$2,444,000

S2100 — Low Cost Friction Stir Welding of Aluminum for LCS Applications Phase 2

Objective

The Littoral Combat Ship (LCS) incorporates significant amounts of aluminum. Friction Stir Welding (FSW) is an ideal joining process for aluminum and provides vast improvements over conventional marine aluminum construction methods because it offers decreased distortion, improved joint properties, and reduced production costs. The objective of this project is to develop a low-cost friction stir welding machine and to demonstrate its operation at a shipyard supporting the Lockheed Martin Team LCS construction. Working with the project Integrated Project Team (IPT), the Navy Metalworking Center (NMC) designed, built, and demonstrated a transportable friction stir welding system that will be transitioned to production use at the shipyard. In operation, the machine essentially serves as an aluminum panel line, forming stiffened panels from edge-welded extrusions.

Payoff

By limiting the design's functionality to the specific needs of extrusion welding, the machine is less costly and provides a quicker return on investment. The simpler machine requires minimal site preparation and is sized for mobility among and within shipyards. By locating the FSW operation at the construction yard, the benefits of FSW are more fully realized because the panels are built to the size needed for construction, rather than being limited to a panel sized for transportation from a remote site. The machine's simplified controls and operation also reduce the skill set and technical support required for the operator. The low capital costs and proven design will enable industry to readily scale-up for multi-ship construction, and do so at a much lower capital cost.

Implementation

Currently, the machine is planned for delivery to Bollinger Shipyards in December 2009 to support construction of the FY10 LCS, which is pending award. Negotiations are ongoing among Bollinger, Lockheed Martin Space Systems (LMSS), Lockheed Martin Maritime Systems and Sensors, the LCS Program Office and NMC regarding an earlier transition to LMSS Michoud facility. The dual-use machine design is available through NMC or the Defense Technical Information Center (DTIC) for other programs or industries in need of flat, thin, stiffened aluminum panel production.

Flexible Antenna System Leads to Reduced Cost and Reduced Number of Antennas

S2126 — Flexible Antenna System for Littoral Combat Ship Phase 2

Objective

Requirements for next-generation shipboard communications equipment needed to support multiple mission scenarios include performing the following roles: intelligence gathering, surveillance and reconnaissance, mine hunting, interdiction of enemy ships, and personnel transportation. The Littoral Combat Ship (LCS) philosophy is centered on the concept of a reconfigurable platform that will be utilized to counter anti-access littoral threats. To meet the various mission requirements of the LCS, electronic communications equipment tailored for that particular mission will be installed on the ship. This presents a problem for interfacing to the various antennas mounted on the ship. The real estate on the ship is limited, and, therefore, it is not possible to mount every antenna that is required for each possible frequency range and application. Hence, there is a need to define antenna systems to be more flexible in terms of their original operating parameters such as frequency, gain, radiation pattern, etc.

The objective of the Flexible Antenna System for Littoral Combat Ship Phase 2 effort is to mature developed demonstration technology to design, build, and test critical hardware components over a section of the 3MHZ-2GHz band and to integrate the hardware to provide a system for transition. The focus is on the development of key technologies that will lead to a significant reduction in cost and the number of communication antennas needed to support LCS mission requirements.

Payoff

The benefits of this project will potentially reduce the number of antennas required on the LCS, the impact on the antenna farm of reconfiguring the ship for various missions, and the overall cost of the antenna system. This project will develop key technologies that will help form a flexible antenna system called the Omni Digital Package (ODP). The resulting system will lead to a significant reduction in the cost and the number of communication antennas needed to support LCS mission requirements. Implementation of the ODP onto the LCS will ultimately result in estimated cost avoidance is $660K per ship, and reduction of the antenna farm number from 26 to 5 antennas. This would allow for the reduction of the 26 specialized antennas through the integration of 1 multi-band integrated mast antenna (possibly OE-538), and approximately 5 additional ancillary antennas that can send and receive over the range 3MHz to 2GHz. Reducing the antenna count will decrease the maintenance burden of the LCS communications system. A 50% weight reduction is also achievable as fewer antennas will be mounted on the antenna mast.

Implementation

Other programs with flexible communications needs will benefit from the techniques developed in this effort. Although there is now no platform identified at this time for this technology, the conclusion of this project will yield a demonstrator comprised of an electrical prototype of the desired hardware. The electrical prototype will exhibit near form-fit factor of the desired final design.

PERIOD OF PERFORMANCE:

April 2007 to October 2009

PLATFORM:

LCS

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EMPF

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STAKEHOLDER:

PMS 501

TOTAL MANTECH INVESTMENT:

$2,901,000

Casting Solution Offers Cost Reduction for LCS

S2216 — Littoral Combat Ship (LCS) Bow Castings

PERIOD OF PERFORMANCE:

September 2007 to
September 2009

PLATFORM:

LCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 501

TOTAL MANTECH INVESTMENT:

$890,000

Objective

The Littoral Combat Ship (LCS) design includes a sharp, raked bow section, which makes connecting the stem bar and adjoining hull plates difficult. The objective of this Navy Metalworking Center (NMC) project is to simplify construction of the bow section of LCS by developing a near-net-shape cast stem that simplifies the connection and greatly reduces both the costs and duration of shipyard construction and inspection.

Payoff

The results of this project indicate that the overall financial impact of implementing the stem casting is a savings of $35.2K per ship. The reduction in installation cost results from the elimination of two complete installation processes and welding, inspection, and supervision costs. Other expected benefits include an improved design of the stem that allows easier connection with the hull plates and reduced production time for the bow.

Implementation

A complete cast stem was purchased by Marinette Marine Corporation, the implementing shipyard for LCS 3, in July 2009. Construction of the bow section for LCS 3 is scheduled for completion by April 2010.

Improved Waterjet Inlet Manufacturing Technology to Reduce Production Cost

S2279 — Waterjet Inlet Tunnel (WjIT) Manufacturing Improvement

Objective

The waterjet inlets on the Freedom-Class Littoral Combat Ship (LCS) have very particular geometry and smoothness requirements. Current shipbuilding practices available to LCS shipyards are not well-suited to producing the intake details. In addition, the intakes are costly to produce in terms of labor and schedule. This project is developing an improved solution for waterjet inlet manufacturing and will provide the necessary development, testing and evaluation of several promising design / technology concepts. The two major focus areas are the production of the tunnel entry edge and the construction and surfacing technologies for the tunnel mid-section transition region.

Payoff

The manufacturing solutions developed in this project will reduce both the production cost and shipyard duration for construction of the Lockheed Martin LCS. It is expected that producing the tunnel entry edge as a cast part will save significant labor hours in fabrication and installation. By reducing the shipyard labor requirements and duration, this project will also improve the yard's ability to produce multiple ships in the fiscal year, as the current shipbuilding plan requires.

Implementation

Potential implementation sites for the cast leading edge are Marinette Marine Corporation and Bollinger Shipyards, Inc., which are authorized to build LCS Freedom Class ships. Shipyard implementation is targeted for FY10; however, early insertion may be feasible if the results of this project are successful.

PERIOD OF PERFORMANCE:

March 2009 to December 2010

PLATFORM:

LCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 501

TOTAL MANTECH INVESTMENT:

$1,785,000

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VCS Projects
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NAVY MANTECH
Manufacturing Technology Program

VCS Projects

Automated Manufacturing of Fiber Optic Sonar Sensors

S0942 — Fiber Optic Conformal Acoustic Velocity Sonar (CAVES) Sensor and Telemetry Manufacturing Technology

PERIOD OF PERFORMANCE:

August 2007 to November 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Electronics

CENTER OF EXCELLENCE:

EOC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$2,872,000

Objective

The objective of this project is to reduce the cost of manufacturing Fiber Optic Acoustic Sensors and related system components. Current methods require significant hands-on labor to wind fiber optic coil assemblies. This project will result in automated manufacturing methods (for example: a dual coil winder machine), written processes, and needed tools to reduce labor costs allowing system components such as delay coils, couplers, acoustic modules, and optical switches, to be produced in required quantities at low cost.

Payoff

Associated design changes to the electronic controls and interface components designed for use with Fiber Optic sensors will initially provide system cost reductions when used with current ceramic sensor applications. Additional reduction in costs are realized when the FO acoustic sensors eventually replace the ceramic type sensors.

There will be a reduction in the quantity of lasers in the receiver from 48 to 12 per ship set, and Array Plates will be eliminated along with the associated installation costs. In summary, the expected savings will be $5.26M per hull for sensors, plus $12.5M per hull due to elimination of other associated hardware for hulls 19 through 26 Block lV. The total savings for hulls 19 through 26 is estimated at $142M.

Implementation

The manufacturing technology developed by this project is planned for implementation beginning with VIRGINIA Class submarine hull number 19 Block lV pending final Government deployment decisions. The planned site is the General Dynamics Electric Boat facility starting in FY14.

Alternative Damping Materials to Reduce Cost on VCS

S2139-2 — Damping Material Application Improvements Phase 2

Objective

Several thousand square feet of damping tile are installed on each VIRGINIA Class submarine (VCS). An opportunity exists to reduce the cost of installed damping by finding alternate materials and/or installation methods. The goal for this Navy Metalworking Center (NMC) project is to reduce the cost of select damping systems by 20%. Alternate adhesives have been down-selected as a cost-effective approach with relatively low technical risk. The down-selected materials are pressure-sensitive adhesives available in peel-and-stick sheets. While the use of a pressure-sensitive adhesive can significantly reduce the cost of damping, some technical deficiencies still exist. The current phase of the project is investigating modifications to the down-selected adhesives to overcome the identified deficiencies. If successful, the material will undergo qualification testing.

Payoff

The total cost per hull of the baseline Type II, Class 2 constrained-layer and 2.5 free-layer damping systems was estimated at $4.98M. The goal is to reduce the cost of select damping systems by 20%, which is estimated at approximately $1.0M per hull. However, the estimated cost savings derived from an installation of an approximately 100-square-foot area was more than 50% for both down-selected candidates. This is an estimated cost savings of up to $2.5M per hull. If the technical hurdles can be overcome, successful implementation of project recommendations may result in cost saving between $1.0M and $2.5M per hull.

Implementation

Upon achieving acceptable cost reduction goals and technical requirements, the Integrated Project Team will recommend that the VCS Program Office (PMS 450) initially invoke an engineering revision (followed by a military specification) for the pressure-sensitive adhesive material to be used with Type II, Class 2 constrained-layer and Class 2.5 free-layer damping as an alternative to MIL-A-24456B, pending successful at-sea test patch results. PMS 450 will be responsible for the at-sea test patch, adoption of the recommended engineering revision (followed by a military specification), and formal changes to design/construction references. The implementing shipyards will be responsible for training of personnel on installation and repair procedures. It is expected that the results of this project will be implemented on SSN 786 in 2012.

PERIOD OF PERFORMANCE:

March 2009 to July 2010

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Nonmetallics

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$711,000

Composite Manufacturing Processes Reduce Sail Cusp Cost

PERIOD OF PERFORMANCE:

April 2007 to June 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Composites

CENTER OF EXCELLENCE:

CMTC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,101,000

S2158 — Composite Manufacturing Technology for Reduced Cost Sail Cusp

Objective

The current VIRGINIA Class sail cusp is a stiffened steel structure comprised of numerous pieces which are welded together, filled with syntactic foam, and welded to the sail and hull structure. Considerable material and labor expense is required to fabricate the steel baseline structure due to the sail cusp's complex double curvature and the number of parts required for fit-up. In addition, because the steel sail cusp must be welded to the sail and hull, it cannot be readily removed for maintenance, and the void space is filled almost entirely with syntactic foam to inhibit corrosion which adds additional weight and manufacturing cost.

The Integrated Bleeding Manufacturing (IBMP) and the SCRIMP / VARTM (Seemann Composite Resin Infusion Manufacturing Process / Vacuum Assisted Resin Transfer Molding) processes both offered the potential to reduce the cost of the legacy steel sail cusp by enabling the fabrication as a one piece, unstiffened monocoque composite structure bolted to the sail and hull. The objective of this effort was to demonstrate the feasibility of using these different manufacturing methods by fabricating subscale and/or full-scale manufacturing demonstration articles using each process, and then selecting the most cost-effective approach which met VIRGINIA Class requirements. The approach provided the ability to address fabrication concerns and to establish realistic costs for fabricating and installing a full-scale sail cusp, and ensured that all required performance issues were met. With respect to the steel baseline, emphasis was placed on developing processes that showed significant reduction in fabrication costs.

Payoff

A cost avoidance of $180K per hull results from the implementation of this technology. A schedule reduction from 14 months to 3 months was also achieved.

Implementation

This project demonstrated the feasibility of two alternative manufacturing approaches to fabricating the VIRGINIA Class sail cusp. General Dynamics Electric Boat (GDEB) material specifications exist for both manufacturing processes. Since performance and manufacturing requirements were met for both processes, the transition to implementation was straightforward. Both methods will be implemented on SSN 784 in December 2009.

World Class Material Flow System Improves Shipbuilding Operation

S2160 — VIRGINIA Class Submarine Material Management

Objective

The objective of this project was to implement a world-class material flow system to support VIRGINIA Class submarine (VCS) construction at General Dynamics Electric Boat (GDEB). There are numerous opportunities to improve the flow of VCS Contractor Furnished Material (CFM) and Government Furnished Material (GFM) within and between shipyards. This project evaluated the performance of the material process from the use of product design, schedule and contract information, demand and supply analysis, and development of Work Orders (WOs) that consume the material, to material procurement and shipment, receipt, inspection, storage, distribution to the trade and consumption during work. A two-phased approach was used to establish an improved material flow system for both GDEB sites. The project team developed a current state value map that illustrates process flow and performance metrics; conducted on-site evaluations of companies considered to have "best in class" material flow processes; captured the materials flow future state vision and future state value map; and developed an implementation plan that identified and prioritized improvement projects that can bridge the gap between the current and future states of material flow. Phase 1 efforts identified the hardware and software needs and process definition for use of the new technology, a training plan for the end-users, and necessary modifications to the construction schedules. Phase 2 activities implemented the improved state of material flow developed. Measurement systems were also established to capture process metric improvements.

Payoff

Reducing VCS construction costs to $2B and cycle time to 60 months is key to increasing acquisition and maintaining the submarine industrial base. It has been estimated that 30% of a submarine's construction cost is directly related to material procurement and management. The material flow system resulting from this project is contributing to lower cycle times, optimal inventory levels, higher material availability rates, and reduced re-manufacture / re-procurement of rejected, damaged, or lost parts. Cost savings of $3.1M per hull realized during the project's execution were included in GDEB's VCS Block III bid and subsequent award. Once fully implemented, it is expected that this project will result in an estimated $5.4M per hull savings ($4M per hull in labor, $1.4M per hull material). Findings from this effort will benefit both GDEB yards and have applicability to other U.S. shipyards as well.

Implementation

Implementation of these material management systems at GDEB began in January 2008. Implementation was executed in a phased approach, with consideration given to the most significant opportunity areas, the length of time required for implementation, and the cost / benefit analysis. At the conclusion of the project, there were 22 projects that had completed full implementation in support of SSN 784, and a balance of 14 that had a project status of "In Work" (critical actions being identified) and "Action Implementation" (critical actions are being implemented). It is expected that these projects will reach full implementation by 2Q10.

Note: This project is led by the Center for Naval Shipbuilding Technology (CNST) with a portion of the work performed by the Institute for Manufacturing and Sustainment Technologies (iMAST).

PERIOD OF PERFORMANCE:

June 2007 to May 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Schedule Compression

CENTER OF EXCELLENCE:

CNST and iMAST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,300,000

Design for Production (DfP) Eliminates Wasteful Steps in the Manufacturing Process

PERIOD OF PERFORMANCE:

April 2007 to April 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

CNST and iMAST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$889,000

S2161 — Design for Production (DfP 0) Process Improvement

Objective

The objective of this project was to assess and evaluate a new methodology utilizing "Design for Production" (DfP) process improvement techniques targeting three key areas: cost-based design, design standards / rules, and seamless deliverables. Navy ManTech funded this two-year, multi-phased effort to ensure the VIRGINIA Class submarine (VCS) production workforce received accurate, configuration-managed, electronic data that met their information needs in a timely manner. This project employed a new knowledge management system and rule-based / cost-based / standardized designs with advanced visualization technology to improve the process for ship systems. Research activities captured the best lean manufacturing capabilities, transformed them into design standards, applied them during design activities, and produced seamless, "on demand" deliverables derived from 3D product models for cost-effective manufacturing. The investigation also addressed implementation issues such as overall process changes necessary to incorporate the new technologies.

Payoff

The General Dynamic Electric Boat (GDEB) shipyard successfully implemented these improved DfP processes, reducing design / engineering and production labor hours and eliminating wasteful steps in the manufacturing process. GDEB has realized a cost savings of approximately $2M per hull in late 2008 and included this savings in the VCS Block III Build Contract Proposal. GDEB continues to capture DfP-related cost savings, with as much as $3.7M per hull recognized to date and potentially as much as $6.8M per hull possible with follow-on savings. The DfP technologies and processes are relevant to any shipbuilding new construction program and provide the design community with manufacturing capabilities, best practices, cost information, and design rules / standards, allowing for design decisions that reduce manufacturing, assembly, and testing costs downstream.

Implementation

New technologies have been implemented at GDEB in both the Groton, CT and Quonset Point, RI sites in April 2009, beginning with SSN 784. Results are being shared with Northrop Grumman Shipbuilding - Newport News and have been disseminated across the shipbuilding industry through numerous presentations, as DfP process improvements are applicable to all U.S. Navy platforms.

Note: This project is led by the Center for Naval Shipbuilding Technology (CNST) with a portion of the work performed by the Institute for Manufacturing and Sustainment Technologies (iMAST).

Outfitting Process Improvements Reduce Man-hours by 30%

S2162 — Outfitting Process Improvement

Objective

Reducing VIRGINIA Class submarine (VCS) construction costs to $2B and cycle time to 60 months is key to increasing acquisition and maintaining the submarine industrial base. With the VCS design essentially complete and the bulk of the construction work ahead, one of the greatest opportunities for cost savings and cycle time reduction lie in the outfitting realm. The objective of this project was to analyze the major processes employed during the outfitting stage of construction, prioritize the areas targeted for improvement, and recommend improvement solutions. This included analyzing foreman time constraints, current scheduling methods and techniques, as well as understanding the various hand-offs of work, information, and material. Phase 1 identified, analyzed and documented the cost impact for each of the major processes involved in outfitting. Phase 2 developed and implemented process improvements plans in areas such as planning, scheduling, and overall work management.

Payoff

Of all naval ships, submarines have the tightest, most congested spaces requiring highly engineered arrangements and tighter tolerances for installation. These strict requirements cause outfitting to consume over 30% (1.5M man-hours) of the total manufacturing span time. Cost savings of $1.8M per hull have been realized to date. Once fully implemented, it is expected that this project will result in an estimated $5M per hull savings. Because VCS construction activities are shared between General Dynamics Electric Boat (GDEB) and Northrop Grumman Shipbuilding – Newport News (NGSB-NN), results from this project have the potential to benefit both yards. Other benefits of this ManTech project include, but are not limited to: increased presence of foremen in outfitting work cells; increased amount of outfitting activities while cylinder / section is in vertical position; earlier layout work for attachments, inserts, cut-outs, and tank marginal plates; reduced amount of manufacturing activities happening in outfitting work cell; and increased efficiency in hand-offs of material, information, and work within and among crews.

Implementation

The VCS Program will directly benefit from the process / tool improvements resulting from this effort. The results may also be relevant to other shipbuilding new construction programs as well. At the conclusion of the project, there were 10 initiatives that were fully implemented. There are 22 initiatives in work and 7 potential future initiatives that were scoped as a result of this project.

Note: This project is led by the Center for Naval Shipbuilding Technology (CNST) with a portion of the work performed by the Institute for Manufacturing and Sustainment Technologies (iMAST).

PERIOD OF PERFORMANCE:

June 2007 to October 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Outfitting

CENTER OF EXCELLENCE:

CNST and iMAST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,700,000

Material Compressibility Improvements Lead to Reduced Cost for CAVES Wide Aperture Array (WAA)

PERIOD OF PERFORMANCE:

June 2007 to March 2010

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Nonmetallics

CENTER OF EXCELLENCE:

CMTC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,629,000

S2166 — Manufacture of DURA Material with Uniform Compression

Objective

Conformal sonar arrays seek to provide an optimally sensor-coated submarine with improved stealth at a lower total ownership cost. New technology called Conformal Acoustic Velocity Sonar (CAVES) will replace existing Wide Aperture Array (WAA) technology and will be implemented on the VIRGINIA Class submarine (VCS). With its reduced complexity and number of parts, the CAVES WAA has the potential for significant cost savings over the current Light Weight Wide Aperture Array (LWWAA) system. In addition, the low cost could result in adding this unique WAA capability to the SSN 688 Class. Currently, uniform material compressibility represents one of the most significant design issues for CAVES WAA, and current legacy hull coating processing techniques do not meet the stricter requirements of a WAA-type system.

The objective of this project is to develop a manufacturing approach to control the constituents used in the fabrication of DURA material through the use of new processing technologies and approaches. A significant benefit of this approach is the control of a filler constituent, which has a significant impact on the compliance of the material. Another possible beneficial solution is the use of alternate filler, which inherently would provide better control of the material compliance. Other potential beneficial solutions to this approach include improved material processors, better procedures, and more precise waterjet cutting techniques.

Payoff

The engineering rough order of magnitude (ROM) cost savings for CAVES over the existing LWWAA is ~$12M per shipset. The ManTech project will enable these savings to be fully realized, and it is anticipated to add an additional $500K savings per shipset in reduced fabrication time and reduced material waste. There will also be undefined cost savings throughout the life of the ship due to reduced rejected material during repairs. This process will improve all hull coatings as well, although the reject rate for other applications is not nearly as high as the CAVES application.

Implementation

The processes and procedures will be implemented in FY12 in the manufacture of the CAVES Array scheduled for installation during new construction. Certification and implementation are being coordinated with NAVSEA. Implementation costs for the DURA process change will be negligible as the tests required will be performed as part of the CAVES certification.

Improved Cladding Workcell Processes Reduced Submarine Manufacturing Cost

S2169 — Cladding Workcell for Submarine Manufacturing

Objective

The objective of this project was to develop and implement a semi-automated work cell to achieve improved affordability during cladding of components used in the manufacture of submarines. Current cladding methods are effective but limited in production rate. Fabrication times for components are lengthy, as the facilities layouts are not optimized. The recent requirement to produce a boat in 60 months rather than 84 months, combined with a production rate of two ships per year, necessitate that both output and capacity are increased.

Payoff

The Cladding Workcell will save 3,314 man-hours per hull, with 1,000 man-hours in savings from welding (representing a 28% man-hour reduction) and 2,314 hours in machining (representing a 30% reduction in machining man-hours). Assuming a manpower rate of $70/hour, savings of approximately $232K per hull or $1.855M for the next block of 8 boats are expected. These savings are achieved by implementing new welding procedures that will take advantage of higher deposition rates, new pre-heat system that will reduce time associated with establishing and maintaining pre-heat, and machining savings obtained by taking advantage of setup efficiencies associated with a pallet-changer system integrated with each machine and reduced machining time associated with utilizing new state-of-the-art machines. Material movement savings have been estimated to be 21,500 man-hours per hull. At the same labor rate, the savings would be $1.5M per hull. For the same 8 boat block, the savings are $12M. Combining the two savings for the 8 boat block, the total savings are nearly $14M.

Implementation

General Dynamics Electric Boat (GDEB) performs cladding operations at both its Groton and Quonset Point facilities. Initial studies involved an analysis of equipment and facilities and determination of the best cladding practices at GDEB. Laser cladding and advanced arc cladding processes were evaluated to determine if it is a feasible alternative based on a cost-benefits analysis. GDEB is in the process of procuring the components required in the automated cladding cell and will implement the system by the end of FY 2010. The components of the new cell will address improvements in cladding, clad pre-heating, machining, and material movement. This project was a joint effort with Navy Metalworking Center (NMC), also see project S2225.

Note: This project is led by the Institute for Manufacturing and Sustainment Technologies (iMAST) with a portion of the work performed by Navy Metalworking Center (NMC).

PERIOD OF PERFORMANCE:

February 2007 to
September 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

iMAST and NMC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$915,000

Composite Impeller to Results in Cost Savings of $1.3M Per Hull

PERIOD OF PERFORMANCE:

June 2007 to May 2010

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Composites

CENTER OF EXCELLENCE:

CMTC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$2,634,000

S2174 — Reduced Cost Impeller

Objective

The current VIRGINIA Class submarine (VCS) impeller is fabricated using a 5-axis machining process on a forged titanium ingot. This is required to achieve the required shape and associated tolerances to meet performance goals. The machining process is very expensive, and the cost of titanium is escalating. The objective of this project was to demonstrate the ability to fabricate a low-cost composite impeller that meets all performance requirements and reduces the cost over the titanium baseline component. The technical approach involved the use of high precision composite segments assembled into a finished impeller with no reduction in performance.

Payoff

The projected payoffs for this project are lower acquisition cost compared to the titanium design. It is expected that this project will save $1.3M per hull. The impeller will not degrade any performance characteristics of the existing pump. The impellers will also be suitable for backfit and reduce the manufacturing time from 9 months to a projected 2-3 months.

Implementation

The implementation plan involves building a full-scale impeller segments and assembling them into a full-scale impeller suitable for a complete set of qualification tests. These qualification tests will occur in the second quarter of FY 2010. It is envisioned the suitable manufacturers of this impeller will be brought in towards the end of the project to relay developments and garner interest in production.

Small Weldment Methods Optimize Material Flow and Reduce Labor Hours by 20%

S2185 — Small Weldment Optimization Cell

Objective

Small weldments at Northrop Grumman Shipbuilding - Newport News (NGSB-NN) are considered any structural parts – generally up to 4-ft by 8-ft and weighing up to 5 tons – that are manufactured or assembled in the small component fabrication and assembly shops. Current manufacturing and assembly methods for small weldments are outdated, requiring significant cost and time. In addition, the process at NGSB-NN is at maximum capacity, and supporting two VIRGINIA Class submarine (VCS) hulls per year plus an aircraft carrier will cause scheduling issues and disruption.

The goal of this effort was to develop processes to enable a 10% to 20% reduction in touch labor for small weldments assembly. This ManTech project analyzed, created, and recommended a process for the assembly of small weldments from fabricated piece parts. The process provided optimized material flow and work sequences, as well as specified new tooling requirements. To accomplish this, the project created a computer-simulated model of the current state and analyzed the process flow, varying work grouping, tooling, labor skill mix, and volume. The analysis has shown a conservative reduction of nearly 28% for some manufacturing processes, indicating that the potential exists to increase cost avoidance and/or increase the throughput rates for a given equipment purchase or process change.

Payoff

At NGSB-NN, small weldments account for approximately 1M man-hours on a NIMITZ-class aircraft carrier (FORD-class carriers are expected to require a similar level of effort) and 200K man-hours per VCS hull (not including similar work performed at General Dynamics Electric Boat). By evaluating process lanes and optimized tooling and using state of the art tools, NGSB-NN expects labor reductions of approximately 40K man-hours per VCS hull and up to 200K man-hours on FORD-class aircraft carriers. This project has the potential to eliminate up to 20% touch labor in the small weldments process, further increasing the per-hull savings of $1.5M already expected for the combined VCS and Carrier programs.

Implementation

The project team evaluated where the majority of the value lied for investments in new tooling for small weldment assembly. NGSB-NN pursued equipment / resource upgrades of its existing small weldment operations using the VCS Capital Expenditure (CAPEX) program. The result of this project is not a specific product or weapon system (or modification thereof) that requires high-level Navy or Program Officer approval for implementation. NGSB-NN expects to complete implementation activities at their ship construction facilities in early 2010. Partial implementation, to include basic process realignment and initial equipment upgrades, began in early 2009.

PERIOD OF PERFORMANCE:

August 2007 to July 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

CNST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$441,000

Automating Hull Layout Reduces Production Cycle Time

PERIOD OF PERFORMANCE:

October 2008 to January 2010

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

CNST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,190,000

S2186 — Automated Install of Studs (iGPS Handtool Integration)

Objective

Metrology equipment has proven to be very effective in identifying positions in space. The objective of this project is to identify and implement applications where this equipment could be utilized to decrease man-hour costs and reduce span times of hull sections.

The project team is investigating the use of various metrology technologies including an internal GPS (iGPS), a laser tracker, targetless total stations, and a rover arm. These technologies will be used to identify the locations of studs both internal and external to the hull, establish single cylinder grid, setup and verify AFC fixtures, conduct hull circularities, layout hull penetrations, and measure and lay out various other foundations and items. In addition this project will reduce time required for stud shooting by furthering stud and stud ferrule standardization. The use of these tools could have a significant impact on overall cost and schedule of the VIRGINIA Class submarine (VCS).

Payoff

Reducing VCS construction costs to $2B and cycle time to 60 months is key to increasing acquisition and maintaining the submarine industrial base. If successful, this project has the potential to reduce span time and save an estimated $428K per ship. Additionally, findings from this effort will benefit both General Dynamics Electric Boat (GDEB) yards (Groton and Quonset Point) and other U.S. shipyards exploring these technologies.

Implementation

New technologies will be implemented at GDEB pending successful project results. Non-ManTech funding will be required for necessary facility / infrastructure upgrades and special automation tools. Aside from these requirements, there are no additional prerequisite testing, qualifications, or certifications required for successful technology implementation at GDEB. GDEB management has expressed their commitment to implementation of these processes (pending satisfactory process metrics and exit criteria are achieved), in an effort to reduce VCS production cycle time from 84 to 60 months and support the program acquisition goal of two subs per year. This technology promises to significantly support VCS cycle-time reduction efforts currently underway at GDEB.

New Fiber Optic Technology Provides Efficient Piping and Conduit Runs

S2188 — Fiber Optic Measurement and Shape Sensing

Objective

Current state-of-the-art position registration devices for piping and conduit runs in ships are bulky, time-consuming to operate, complex, and costly. They require expensive equipment and subject-matter experts to operate. This project will develop a new shop floor technology and provide manufacturing techniques for efficient submarine and ship assembly. It will offer distributed, precise, and real-time position registration for fast and accurate assembly. The objective of this project is to design, build, test, demonstrate, and document a fully functioning prototype fiber-optic position measurement system for transition to the VIRGINIA Class submarine (VCS) production facility. This will be used in the shipbuilder contractor Dimensional Control departments.

Payoff

The initial application will target reduction in dimensional control support man-hours for ship fitters, machinery installation, pipe shop departments, small weldment fitter shops, and fabrication shops. This is projected to translate into a cost reduction of approximately $800K per hull by the prime contractor and $390K per hull for subcontractor assembly. The benefits to VCS will be to provide a simplified, automated, time-effective, accurately-aligning manufacturing technique for efficient positioning of piping and conduit runs to enable significant cost reduction during production. The new technology will also significantly reduce processing time for photogrammetry, which will support overall schedule reduction.

Implementation

The Fiber Optic Measurement and Shape Sensing System (FOMSS) is scheduled for initial beta testing on SSN 783 on the shop floor at Northrop Grumman Shipbuilding - Newport News starting in January 2010, with full production application on SSN 784.

PERIOD OF PERFORMANCE:

November 2007 to April 2010

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Outfitting

CENTER OF EXCELLENCE:

EOC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$535,000

Improved Production Engineering Management Tools Result in Reduced Construction Time and Cost

PERIOD OF PERFORMANCE:

September 2007 to
December 2011

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

iMAST and CNST

POINT OF CONTACT:

Mr. Timothy D. Bair
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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,789,000

S2189 — Improved Production Engineering Management Tools

Objective

General Dynamics Electric Boat (GDEB) is committed to compressing the construction span time of a VIRGINIA Class submarine (VCS) hull, thus reducing the unit cost. The objective of this project is to develop a data system and set of tools that integrate high-level planning information with detailed resource requirements. The data system will link with GDEB legacy systems for accurate and timely data and information. The tools developed as part of this project will interact with the data system to enable planners, production engineers, and production managers to visualize, analyze, and modify detailed production schedules. The users will have the ability to react quickly to high-level planning changes as well as mitigate any schedule or resource aberrations.

Payoff

The data system and toolset developed in this joint project is expected to reduce the overall labor of VCS construction at Quonset Point by 0.8%. Currently, Quonset Point requires 2.7M man-hours for every VCS constructed which would result in a rough order magnitude cost savings of approximately $1.3M per hull.

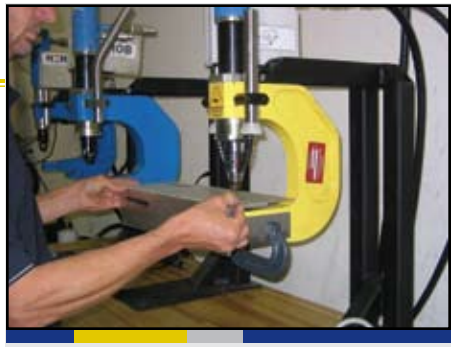
Implementation

To ensure maximum transition / implementation, the project team is working closely with stakeholders to ensure that the tools / technologies meet their needs and support the manufacturing processes. The project team has adopted an industry standard development technique that gathers input from the end users prior to the development of the software. In addition, the users are requested to use and provide feedback on the tools through several iterations. Using this technique, the tools will be transitioned, and the users will be trained on the final software applications. Using this strategy makes the transition of the tools an integral part of the development and allows for implementation very shortly after the end of the project. To demonstrate the benefit of the data system and toolset, the project team will perform a pilot demonstration using a subset of the total data in the legacy planning systems. Full implementation will be sought pending the successful demonstration of the pilot system.

Note: This project is led by the Institute for Manufacturing and Sustainment Technologies (iMAST) with a portion of the work performed by the Center for Naval Shipbuilding Technology (CNST).

Fabrication Techniques Enable Greater Efficiency and Affordability in Sheet Metal Processing

S2191 — Sheet Metal Processing



Objective

Submarine construction includes significant fabrication of sheet metal products comprised of a wide variety of sizes and shapes that necessitate costly hand-fitting and fabrication and utilize manual joining techniques. This project is identifying and developing alternate methods for sheet metal joining and fabrication to improve affordability of the VIRGINIA Class submarine (VCS) that will be implemented at the General Dynamics Electric Boat (GDEB) Quonset Point, RI sheet metal facility. A concurrent engineering methodology along with analysis of process flow is being used to refine designs and manufacturing schemes. A project team has been assembled based on resident technologies and expertise that supports development and implementation activities. Capital improvements will be identified.

Payoff

Based on the level of work associated with sheet metal fabrication at GDEB, a 15% improvement in efficiency is anticipated to result in a cost avoidance of $1.25M per year per hull. This cost avoidance is based on a conservative efficiency estimate. If two hulls per year are factored into the analysis, and the second hull benefits at a level of 50% of the initial 15% improvement, anticipated cost avoidance will be $937.5K per hull per year. Over a three-year period (representing six hulls), the expected cost avoidance will be approximately $5.625M. This estimate ignores secondary cost avoidance associated with reduced part count and inventory, reduced rework due to improved accuracy of components, and increased product flow.

Implementation

The primary implementation site for this technology is GDEB, and a secondary implementation site is at Northrop Grumman Shipbuilding - Newport News (NGSB-NN). The project is being conducted with close cooperation and input from GDEB, with NGSB-NN monitoring progress and having an opportunity for input. The technologies described in this project will compliment the new cutting and forming capabilities recently installed at the GDEB sheet metal fabrication facility. Initial implementation at GDEB is scheduled for the summer of 2009, keeping with the accelerated build schedule planned for GDEB. Procurement of new equipment resulting from this project has been addressed and is considered acceptable by GDEB based on a positive business case analysis. Funds will be available through internal GDEB investment.

Note: This project is led by the Institute for Manufacturing and Sustainment Technologies (iMAST) with a portion of the work performed by the Navy Joining Center (NJC).

PERIOD OF PERFORMANCE:

April 2007 to September 2010

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

iMAST and NJC

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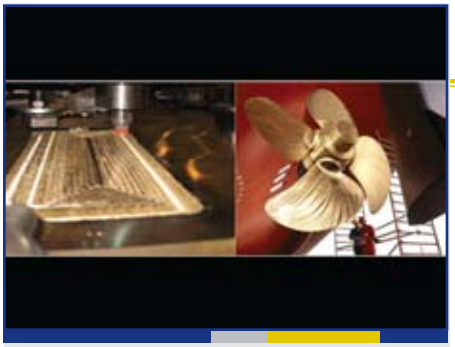
STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,075,000

Process Improves Performance and Reduces Repair Costs for Submarine Propellers



PERIOD OF PERFORMANCE:

April 2007 to December 2010

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$862,000

S2196 — Friction Stir Processing of Nickel Aluminum Bronze Propellers

Objective

In-service repair of ship and submarine propellers is a significant recurring cost to the Navy. In-service repair of propellers is required to restore damage due to corrosion, erosion, and blade deformation. Current practice is to repair defects and rebuild surfaces by arc welding, and then straighten where necessary to restore the correct geometry. The objective of this project is to improve fleet readiness, and reduce costs and cycle time for repair and maintenance of in-service submarine propellers by adapting advanced welding and friction stir processing methods to propellers. Presently, welding is limited to gas metal arc welding (GMAW) for the flat position and gas tungsten arc welding for out-of-position repairs. Some of the most recent designs make propeller removal extremely difficult, making it more expensive to repair these propellers on the vessel. This requires use of gas tungsten arc welding, a process that is not highly productive and not very practical when a large amount of welding is required. Therefore, improved methods are needed that can reduce the time and cost of repairing propellers as well as increase the strength and extend the time between repair cycles.

The Navy Joining Center (NJC) is working with the Naval Surface Warfare Center - Carderock Division (NSWC-CD) to develop new joining technologies to meet this need. Friction stir processing is a solid-state welding process used to repair surface and near surface defects and increase the material strength. This process can be combined with a robot to provide a portable method for in-service propeller repair. Friction plug welding is a portable solid-state joining method being investigated for localized repairs. In addition, pulsed gas metal arc welding procedures are being developed to permit high-productivity, out-of-position arc welding of those propellers that cannot easily be removed from the vessel.

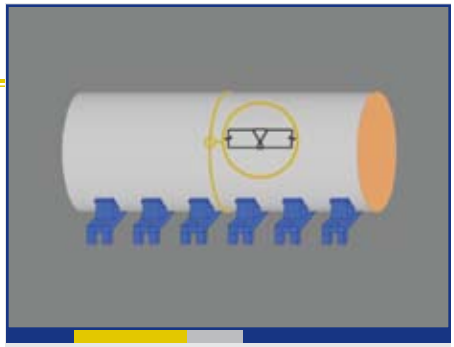
Payoff

The benefits of new repair technology developed during this project will improve fleet readiness and reduce costs and repair time for propellers. Implementing friction stir processing can speed-up the repair of surface and subsurface defects and locally strengthen critical areas. In addition, implementation of pulsed gas metal arc welding and portable friction plug welding can permit repairs without having to remove the propeller from the vessel. These improved welding and processing methods will result in labor cost savings; decreased repair times, and extended service life. It is estimated that friction stir processing alone can save $400K per year in repair costs.

Implementation

The project supports implementation of friction stir processing and improved welding processes for repair of propellers at the Naval Foundry and Propeller Center (NFPC), Wartsila Defense, and other facilities where in-service repairs are performed. The project includes certification of the friction stir process, development of a friction stir processing robot system, qualification of the processes developed and their transition to user facilities. Implementation will be scheduled to coincide with production and repair schedules at the completion of the project. Initial transition for GMAW repair of propellers occurred in late 2009. The friction stir process procedure is to be transitioned to Wartsila Lips in September 2010. Once the technologies are transitioned, the NFPC and Wartsila Lips will track the implementation of the results of this project and the resulting cost benefit.

Savings Result from Improved Hull Fabrication and Assembly Welding



S2197 — Improved Hull Fabrication and Assembly Welding

Objective

The need for continuous improvement in manufacturing costs of VIRGINIA Class submarines (VCS) is a high priority for the Navy and the shipyards that build VCS. The overall goal is to reduce construction costs from $2.4B to $2B per hull as well as to cut construction time from 84 months to 60 months. A key part of this project is reducing ship construction labor costs, including those for welding operations. The Navy Joining Center (NJC), General Dynamics Electric Boat (GDEB), and Northrop Grumman Shipbuilding - Newport News (NGSB-NN) identified opportunities to apply new manufacturing processes and technologies to reduce the costs of welding hull cylinders and subassemblies. A preliminary estimate indicates a goal of 20% reduction in labor for welding and assembly of hull structures is achievable through improvements in technology, processes, and procedures.

The objective of this project is to reduce construction costs for VCS by developing and applying technology to reduce welding costs for hull fabrication and assembly. This project is focused on new technology to automate, mechanize, and increase the productivity of fabrication operations that include welding horizontal hull butt joints, hull inserts, and penetrations.

Payoff

Savings will result from improvements in horizontal butt welding, welding of hull inserts, and penetrations through improved joint preparations, mechanization, and increased deposition rates. The estimated cost savings at GDEB are $214K per hull.

Implementation

This project supports construction of VCS and the cost reduction goals of GDEB. Transition plans include demonstrations of capabilities that will be combined with the results of risk and business case analysis to provide justification for GDEB's commitment to implement the results of the project. The first whole ship impacted by the results of this project will be SSN 788. Implementation is currently anticipated in December 2010.

PERIOD OF PERFORMANCE:

November 2007 to September 2011

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Schedule Compression

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,175,000

Welding Improvements to Reduce Costs for Structural Fabrications

PERIOD OF PERFORMANCE:

November 2007 to September 2010

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,558,000

S2199 — Structural Fabrication Welding Improvement

Objective

General Dynamics Electric Boat (GDEB) and the Navy are committed to reducing the cost and construction time for VIRGINIA Class submarines (VCS). The cost reduction goal is to cut the cost of construction from $2.4B to $2B per hull. Part of achieving this goal involves reducing construction time for a single submarine from 84 months to 60 months. A key part of this project is addressing reducing ship construction labor costs, including welding operations. The Navy Joining Center (NJC) is supporting General Dynamics Electric Boat (GDEB) in this project to reduce the time and cost of structural welding operations.

The objective of this project is to reduce construction costs for the VCS by introducing new welding methods and technology that increase welding efficiency for structural fabrication operations. The goal is to increase weld deposition rates thereby reducing welding costs for structural fabrications by a minimum of 20%. The project team is focusing the majority its efforts on the fabrication of large, complex internal structures.

Payoff

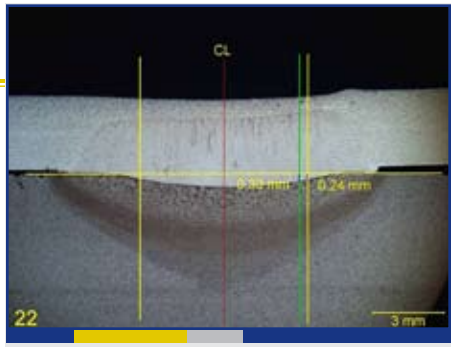
Savings will result from improvements in the quality and accuracy of weld preparations through better gouging and mechanization; increased welding deposition rates and arc time through use of fixtures, positioning, automation, and mechanization; and improvements in preheating, welding processes and equipment. The estimated cost savings at GDEB are $118K per hull.

Implementation

This project supports construction of VCS and the cost reduction goals of GDEB. Results of the risk analysis and business case analysis will provide justification for GDEB's commitment to implement the results of the project. The first whole ship impacted by the results of this project will be SSN 788. Implementation is currently anticipated in December 2010.

Alternative Joining Methods Result in Cost Reduction for Sheet Metal Construction

S2204 — Sheet Metal Affordability Improvement for VCS Phase 1 and Phase 2



Objective

The objective of this project was to reduce construction costs for VIRGINIA Class submarines (VCS) by developing alternate joining techniques that enable greater efficiency and affordability in sheet metal construction. A submarine includes a significant number of fabricated sheet metal products, such as electrical enclosures, racks, lockers, and HVAC ducting. While these products have many common features, the submarine requires a wide variety of custom built sizes and shapes. The variations in the design and size of these components necessitate the use of costly hand fitting and fabrication methods.

The Navy Joining Center (NJC) participated in a project team led by the Institute for Manufacturing and Sustainment Technology (iMAST) and identified alternate joining techniques that reduced the cost of sheet metal construction. Examples of potential processes included: self-piercing rivets, adhesive bonding, gas metal arc welding, resistance welding, and laser welding. Many of these methods have proven their reliability and affordability for sheet metal applications in the automotive and aerospace industries. The initial phase of the project identified resistance spot welding (RSW), gas metal arc welding (GMAW), and adhesive bonding processes as having advantages for sheet metal construction. Further work concentrated on RSW of deck plates and GMAW of heating, ventilation, and air conditioning (HVAC) components. RSW was qualified for construction of deck plating using existing General Dynamics Electric Boat (GDEB) equipment. Welding parameters were developed for GMAW of HVAC components, and a training session was held at GDEB.

Payoff

Operations estimates show in excess of $27K savings per hull using the RSW process for deck plating. For GMAW of HVAC components, the savings are estimated at almost $200K per hull. Both processes reduce overall labor time and thus support reduced span time. In addition, both processes have the potential for expanded use within the shipyard.

Implementation

This project supports construction of VCS and the cost reduction goals of GDEB and Northrop Grumman Shipbuilding - Newport News (NGSB-NN.) RSW of deck plates has been successfully implemented at GDEB's sheet metal shop using existing capital equipment. GMAW for HVAC equipment is being further investigated by the welding engineers at GDEB for possible future implementation in FY 2011.

Note: This project is led by the Institute for Manufacturing and Sustainment Technologies (iMAST) with a portion of the work performed by Navy Joining Center (NJC).

PERIOD OF PERFORMANCE:

November 2007 to
July 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

iMAST and NJC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$325,000

Improved Steel Casting Practices to Reduce Rework and Improve Delivery Time for VCS

PERIOD OF PERFORMANCE:

July 2007 to
November 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$788,000

S2207 — Steel Casting Optimization

Objective

The Navy Metalworking Center (NMC) is working with Northrop Grumman Shipbuilding - Newport News (NGSB-NN) and the VIRGINIA Class submarine (VCS) Program Office to evaluate current VCS hull insert casting problems, such as inclusions (i.e., foreign particles) and entrapped gas. Using the information gathered, test castings are being prepared based on identified clean steel practices. The objective of the project is to reduce casting costs and delivery time by improving the cleanliness of high-strength steel during melting and casting, thereby increasing casting quality, improving mechanical properties and reducing rework.

Payoff

The identified clean steel practices are expected to lower costs by reducing rework and reheat treatments. This will result in an estimated annual savings of $700K to the Navy. Casting delivery time will also be improved by an estimated 55 days for large steel castings.

Implementation

The clean steel technology developed under this project is being incorporated into NGSB-NN Foundry standard operating procedures for hull insert castings and is applicable to other VCS components and marine structures. The following technologies / activities have been successfully demonstrated and have been implemented into casting process designs: (1) filters in gating systems, (2) specialty sands in selected areas, and (3) appointment of a full-time sand manager. Improved sand processing methods have resulted in more consistent sand properties. Additional improvements to mold preparation methods will be evaluated in early Fall 2009 through the use of confirmation castings.

Utilization of DfP Principles Reduces Manufacturing, Assembly, and Testing Costs

S2209 — Design for Production Knowledge Tools (DfP 1)

Objective

Although design of the VIRGINIA Class submarine (VCS) is essentially complete, there are seven new naval ship designs in the immediate future along with impending re-engineering of the VCS for cost-reduction purposes. Recent independent studies have concluded that Design for Production (DfP) is the single most influential factor to reduce ship production cycle time and costs, as ship design processes are not keeping pace with state-of-the-art manufacturing practices. This ManTech project developed and implemented a tailored state-of-the-art knowledge management system, hosted by the General Dynamics Electric Boat (GDEB) DfP intranet, complete with tools that enable authoring, configuration management, and access to DfP rules and standards. These capabilities convey producibility criteria to designers who are working ship alterations, technology insertions, and new design development, as well as those improvements dedicated strictly to cutting production costs. As part of this effort, the project team identified DfP knowledge management requirements for each design discipline; defined and documented DfP processes; designed topic maps for each discipline; implemented both topic and process maps; and demonstrated the developed DfP knowledge system. The project team also addressed implementation requirements of the DfP topic/process maps.

Payoff

In order for the VCS program to be affordable, the cost to build one submarine must be less than $2B and must be completed in less than 84 months; current costs exceed $2B and cycle time is closer to 84 months. While this ManTech project is one supporting element of the overall DfP mission, its specific contribution is estimated to significantly increase the utilization of DfP principles on the order of $0.5M per hull. The resulting technology provides the design community with manufacturing capabilities, best practices, cost information, and design rules/standards allowing for design decisions that reduce manufacturing, assembly, and testing costs downstream.

Implementation

The GDEB team has developed a tailored DfP 'knowledge management' system, hosted by and operational on GDEB's DfP intranet site, available to all GDEB departments on all levels. The system provides access to the topic and process maps previously prototyped and accepted by the end users, rolled out for use January 2009 at GDEB's ship construction facilities at Groton, CT and Quonset Point, RI. Cost avoidances and cycle time reductions resulting from this project are estimated to begin as early as production of SSN 784.

PERIOD OF PERFORMANCE:

October 2007 to
November 2008

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

CNST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$450,000

Seamless Delivery of 3D Product Model Data Reduces Cost Per Hull by Over $500K

PERIOD OF PERFORMANCE:

October, 2007 to March, 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

CNST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$400,000

S2210 — Seamless Delivery of 3D Product Model (DfP 2)

Objective

Recent independent studies have concluded that Design for Production (DfP) is the single most influential factor to reduce ship production cycle time and costs, as ship design processes are not keeping pace with state-of-the-art manufacturing practices. The production work force must receive timely, accurate, configuration-managed, electronic data on-demand; meeting their information needs. This ManTech project evaluated existing construction data models and proposed new expanded 3D product model concepts for the VIRGINIA Class submarine (VCS) program. The General Dynamics Electric Boat (GDEB) team developed and implemented a DfP "seamless deliverable" that supports manufacturing sequence workbooks.

Payoff

GDEB is using this expanded digital product model data in conjunction with the new knowledge management system and advanced visualization technology, improving the process for design and fabrication of ships' structures. The cost of information duplication, data integration, information formatting, configuration management, data interpretation, and purging is being significantly reduced with each new '3D work product', the concise, detail-specific work package visual aid. The conservatively derived cost savings is estimated to be on the order of $575K per hull.

Implementation

The full-scale 3D Product Model has been partially implemented for use at GDEB's Groton and Quonset Point facilities for VCS hull SSN 784, and results are being shared with Northrop Grumman Shipbuilding - Newport News.
While initial implementation of the methodology is already accomplished at GDEB on a limited basis through the use of DfP manual published and made available to the entire engineering/design community, further development and implementation will be meshed with the next generation Integrated Product Development Enterprise schedule. Further process development and related improvements will be limited to those areas identified by the trades as potential areas of opportunity for the existing VCS Program. As these areas are identified and justified, seamless deliverables will be developed using the process as documented in the DfP Manual. Cost avoidances and cycle time reductions resulting from this project are expected to be realized during the production of SSN 784.

Design for Production Tools Reduces Cost (DfP 3)

S2231 — Design for Production Design Alternatives that Reduce Manufacturing Costs (DfP 3)

Objective

Recent independent studies have concluded that Design for Production (DfP) is the single most influential factor to reduce ship production cycle time and costs, as ship design processes are not keeping pace with state-of-the-art manufacturing practices. The production workforce must receive timely, accurate, configuration-managed, electronic data on-demand; meeting their information needs. This ManTech project focused on two key DfP areas: (1) cost-based design drivers and rules by manufacturing shop and design phase, and (2) work cell specific manufacturing best practices and rules as candidates for design standards. The objective was to capture the best proprietary lean manufacturing capabilities, transform them into design standards and cost metric tools, and have them readily available for application during design activities for the VIRGINIA Class submarine (VCS) program.

Payoff

This project investigated DfP standard and cost data models as a follow-on activity to the DfP process methodology developed and implemented by the Design for Production Process Improvements effort and integrated into existing processes and tools. It addressed the implementation issues associated with the new DfP process, automated data gathering, and electronic delivery to the design workforce. It also evaluated the savings and accuracy of using standards and cost information relative to today's design/build practices. Potential DfP improvements savings related to construction costs range from 10-30%. While this ManTech project is one supporting element of the overall DfP mission, its conservative contribution is estimated to ultimately reduce VCS production costs by approximately $500K per hull.

Implementation

New technologies are being implemented at General Dynamics Electric Boat (GDEB) in both Groton, CT and Quonset Point, RI sites at appropriate insertion points. Electric Boat has issued the necessary documentation (Technical Directive) to implement the DfP Process company-wide and is currently proceeding to use the process, capture user feedback on the process and tools developed as part of the process, and continually looking to improve, automate, and further validate the Design for Production process. Though this ManTech project is over, GDEB is studying other areas at Quonset Point to assess implementation probabilities. The applicable technologies have been implemented relatively quickly, as GDEB continues to reduce VCS production cycle time from 84 to 60 months to support the program acquisition goal of two subs per year. GDEB could realize savings attributed to this project's success as early as SSN 784 construction activities.

PERIOD OF PERFORMANCE:

February 2008 to June 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

CNST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$454,000

Improved Preparation and Welding Methods of Smaller Diameter Pipes Reduced Costs on VCS

PERIOD OF PERFORMANCE:

October 2007 to September 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$844,000

S2224 — Pipe Preparation and Welding Methods

Objective

VIRGINIA Class submarines (VCS) contain off-hull new construction pipe welding methods that involve complex configurations for smaller diameter pipe (< 3-inch diameter) for set-up, fit-up, fixturing, and pipe welding applications. The objective of this project was to reduce the manual pipe preparation and welding process labor of small diameter pipe details by 20%, or 9,000 man-hours per hull. To do this, the Navy Metalworking Center (NMC) and the Integrated Project Team developed prototype pipe fitting tools – a modified Accu-fit tool and a ball pivot tool – which reduces manual fitting needed on small diameter pipe details. NMC also developed a mobile weld fixture to be used in the welding of pipe bosses that has the potential to reduce manual welding pass times by 50%.

Payoff

As a result of this effort, a 20% reduction in manual pipe fitting methods and handling of small diameter pipe will provide an increase in pipe fitting and welding automation methods which reduce the pipe labor cost by $500K per hull.

Implementation

The pipe fitting tools and automation methods developed in this project were evaluated for process improvements at the General Dynamics Electric Boat (GDEB) and Northrop Grumman Shipbuilding - Newport News (NGSB-NN) pipe shops. They are now undergoing demonstration testing at those shipyards and will be implemented on SSN 785 in October 2009. Several inspection and welding tools identified by NMC have been transitioned and are already utilized at GDEB Quonset Point facility. The tools are estimated to save 1,250 man-hours per hull. The results of this project could also be applied to CVN, DDG 1000, and commercial shipyard pipe shops.

Arc Cladding Techniques Reduced VIRGINIA Class Submarine Production Cost, Maintain Quality Requirements

S2225 — Improved Arc Cladding Techniques

Objective

The current cladding process utilized by General Dynamics Electric Boat (GDEB) in VIRGINIA Class submarine production is hot wire gas tungsten arc welding (HW-GTAW). The cladding rate of nickel-based materials onto HY-80 and HY-100 components is restricted by heat input, dilution rate and interpass temperature limits. This Navy Metalworking Center (NMC) project was developed to evaluate arc-cladding processes, down-select a candidate process, and demonstrate the ability to qualify the cladding procedure based on NAVSEA Tech Pub 248 requirement.

Payoff

The developed procedure increased the deposition rate from the present level of 6 lbs per hour to a target level of 10 lbs per hour without degrading the clad quality and while maintaining appropriate final weld layer chemical composition. This project demonstrated that the deposition rate of the HW-GTAW cladding process could be increased to 10.8 lbs per hour with conventional parameter optimization. The introduction of a secondary cold wire feed further increased the deposition rate to 12.8 lbs per hour (72% over the base rate). Tests from both processes met the Tech Pub 248 and GDEB requirements. This increase in deposition rate is expected to result in a savings of $1.2M over the remaining VCS Program. The technology will result in both cost reduction and reduced cycle time.

Implementation

GDEB has down-selected the enhanced HW-GTAW with cold wire feed process and included this requirement in a March 2009 specification for an improved cladding cell. An internal capital equipment request was prepared by GDEB based on the acquisition of three, high-deposition welding systems. The technology chosen will be implemented at the Groton, CT, and Quonset Point, RI, shipyards. The first "Hot Wire TIG Station" is scheduled to be installed and operational at Quonset Point by March 2010. This unit will be used for pipe welding and potentially to qualify the enhanced cladding procedures developed by NMC. Three additional HW-GTAW systems have received GDEB Corporate approval and are awaiting SUPSHIP approval upon which they are intended to be installed at the Groton shipyard. Implementation will require GDEB weld lab qualification and appropriate approvals.

Note: This project was led by the the Navy Metalworking Center (NMC) and a portion of the work supported by the Institute for Manufacturing and Sustainment Technologies (iMAST).

PERIOD OF PERFORMANCE:

November 2007 to April 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC and iMAST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$400,000

Cold Forming Technique Reduces Manufacturing Costs on VIRGINIA Class Submarines

S2229 — Cold Forming of Alloy 625 Fittings

PERIOD OF PERFORMANCE:

December 2007 to December 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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Dr. Daniel L. Winterscheidt
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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,236,000

Objective

The cost to produce seamless Alloy 625 large-bore elbows is high due to expensive raw material and forming costs. The project objective is to reduce the manufacturing costs of Alloy 625 piping systems on VIRGINIA Class submarines (VCS). This project will demonstrate that a newly identified closed-die, cold forming technique can be economically and successfully applied to manufacture large-bore, seamless elbows made of Alloy 625, a nickel-based alloy.

Payoff

The new cold forming process results in minimal thinning of the wall in the heel of the elbow, thereby allowing the wall thickness in the starting pipe to be reduced. The reduced wall thickness equates to less raw material required for a ship set of fittings. Cost savings is based solely on the current market price for the raw material used to manufacture the Alloy 625 elbows. Raw material cost savings have been found to range from $660K to $150K per VCS shipset.

Implementation

The project will position the forming vendor to compete in the next multi-hull procurement by General Dynamics Electric Boat, starting with VCS SSN 792. Northrop Grumman Shipbuilding - Newport News has already procured seamless Alloy 625 elbows formed via the identified process for CVN 78 Class. The new manufacturing process is applicable to new construction, overhaul and repair and can be further extended to Alloy 625 piping systems on all Navy platforms.

Simulation Models of VCS Machine Shops to Save Manufacturing Costs

S2230 — VIRGINIA Class Submarine Machine Shop Modeling and Simulation Analysis

Objective

Given the projected increase in production rates with the 84-60 (60 months versus 84 months to fabricate one boat) and two boats per year initiatives for the VIRGINIA Class submarine (VCS) Program, the shipyards at General Dynamics Electric Boat (GDEB) needed to determine if there was sufficient capacity in its current machine shop facilities to meet the increased demand. This project has successfully met the objective to develop discrete event simulation models for both the Groton and Quonset Point machine shops at GDEB. The analyses completed during the course of the project showed that both machine shops were able to meet this increased production schedule by modifying manning schedules and making additional capital investments. The models were intended to be continuous decision-making tools updated with current data and practices respective to each machine shop and used by GDEB in future analyses. They were developed to provide trained users the ability to manipulate the models and generate results for decision makers to act upon.

Payoff

The cost benefit analyses performed by GDEB show that there is a potential cost avoidance of approximately $340K per year, which may be associated with the establishment and continued use of the machine shop models at Groton and Quonset Point.

Implementation

Actual changes to be implemented at the machine shops have not yet been finalized as the production planning, machine shop management, and modeling teams at GDEB have identified additional scenarios to be run using the simulation models. This is in line with the implementation priority for the project, which is for GDEB to continue using the simulation models to address ongoing VCS Program changes that affect the machine shops. GDEB will note the future implemented changes during FY10 at the Groton and Quonset Point machine shops and the role the simulation models served in determining which changes were implemented.

PERIOD OF PERFORMANCE:

November 2007 to June 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Production Engineering

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$980,000

Manufacturing Technology Reduces Cost of Composite Tail Cone by $1M

S2239 — VIRGINIA Class Submarine Composite Tail Cone

PERIOD OF PERFORMANCE:

November 2008 to October 2010

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Composites

CENTER OF EXCELLENCE:

CMTC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,721,000

Objective

The VIRGINIA Class Program Office is looking for solutions to reduce acquisition cost and achieve a cost goal of $2B per hull. One target to help achieve this goal is the current VA tail cone. The current metallic design is expensive due to the high material and manufacturing cost of the nickel-copper metallic structure and associated ancillary costs.

The objective of this project is to replace the metallic tail shell with one made of composite materials and a metallic interface ring, reducing the acquisition cost of the VA tail cone assembly. The overall concept is to fabricate a composite shell for most of the tail cone structure with a forward metallic interface ring leading into the hub. The U.S. Navy believes the concept is low risk and leverages technology and design efforts already completed and verified.

Payoff

The costs associated with casting and machining the existing material system is quite high. Development of a manufacturing technology for the composite tail cone will reduce the cost of the tail cone by $1M, which is a significant contribution to the acquisition cost savings of the VIRGINIA Class submarine (VCS). Additional benefits include the removal of secondary manufacturing processes from the tail cone.

Implementation

Many composite manufacturing options are available to optimize the cost reduction. Filament winding in particular seems to potentially provide the greatest reduction and lends itself to building two at a time. As part of a risk reduction effort both filament winding and Integrated Breathing Manufacturing Process (IBMP) will be pursued to ensure a viable cost saving technology can be transitioned to the VCS. Ensuring the component can meet ship requirements will influence the optimized solution. A series of flat panel tests will be performed as part of the ManTech effort to verify each process meets the design requirements. Naval Surface Warfare Center - Carderock Division will also perform residual stress tests and ring tests to verify quality and survivability in the second quarter of FY 2010.

Manufacturing Processes Reduce Rejection Rate and Improve Production Costs and Lead Time

R2240 — Weapons Cradle Manufacturing Improvement Rapid Response Project

Objective

VIRGINIA Class submarines (VCS) SSN 774 use weapons cradles to handle 21" diameter weapons from the time they are loaded onto the ship until just prior to launch via the torpedo tubes. General Dynamics Electric Boat (GDEB) and Northrop Grumman Shipbuilding - Newport News (NGSB-NN) have encountered significant issues maintaining the very close dimensional tolerances for this long (approximately 21 feet), thin structure manufactured with a very large amount of welding. Any rework or scrapping is very costly to the program. The objective of this project was to reduce the cost of each VCS by improving the producibility of the submarine weapons cradles. The weapons cradles are used to secure weapons from the time they are loaded onto the ship until just prior to their launch. Because a large amount of welding is used to fabricate the long, thin assemblies, it is difficult to construct them and meet the precise dimensional tolerances.

Payoff

By implementing the project's results, the rejection rate and rework of weapons cradles will greatly decrease, leading to improved production costs and lead time. The Navy Metalworking Center examined the current weld processes, detailed drawings, and weld sequencing to identify ways to reduce weld-related distortion. NMC also provided recommendations to optimize welding fixtures to support the manufacturing process. The necessary work instructions, design changes, and training or procedural changes have been developed for 10 of the 15 recommendations identified. These recommendations are conservatively estimated to save $160K per shipset.

Implementation

General Dynamics Electric Boat and Northrop Grumman Shipbuilding - Newport News will partially implement the 10 recommendations for the weapons cradles being built for SSN 780 and fully implement those recommendations on cradles for SSN 781 in the spring of 2010.

PERIOD OF PERFORMANCE:

April 2008 to April 2009

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$89,000

Advanced Visualization System Improves Sequencing and Scheduling Aspects of the Outfitting Process

PERIOD OF PERFORMANCE:

May 2009 to May 2010

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Outfitting

CENTER OF EXCELLENCE:

CNST and iMAST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$790,000

S2241-A — Outfitting Process Improvement-Sequencing and Scheduling

Objective

The objective of this project is to develop and implement the use of an advanced visualization system to improve the sequencing and scheduling aspects of the outfitting process. This tool will provide the ability to visualize the assembly and disassembly of submarine components internal to the hull. Through the development of this system, the user will be able to analyze quickly and easily where work is being accomplished and ensure that it is being done in correct sequence and as early as possible in the manufacturing and outfitting sequence. Furthermore, this project will determine an optimal sequence for which a given assembly is to be built in the outfitting phase, resulting in minimized cycle time. This will enable maximized weld mechanization while reducing manual welding. Utilization of an interactive tool will enable the planning and outfitting trades to accomplish the following: view the product model of the unit; determine the most optimum method of manufacturing and installation; and conduct pre-requisite planning. These tools will provide improved capability for fit-up, welding, sheet metal, electrical, pipe, sound dampening, and outside machine shop detail-planning applications. This project will also advance the development of General Dynamics Electric Boat's (GDEB's) One-Stop Software, a tool that extracts geometric data for the VIRGINIA Class submarine (VCS) structure and facilitates the planning process.

Payoff

The implementation of a manufacturing and outfitting facility with capabilities such as these has been identified as one of the essential components and priorities to significantly reducing the costs of the VCS to $2B per boat. By developing an advanced visualization system to improve the sequencing and scheduling aspects of the outfitting process, GDEB expects a 25K man-hour labor reduction per VCS hull in addition to significant reductions on manufacturing span times for outfitting. It is estimated that this project will save an approximately $1.5M per VCS hull.

Implementation

The efforts put forth in this project will facilitate GDEB's commitment to compress the construction span time of a VCS hull from 84 to 60 months. The incremental development of the project is expected to result in the execution of process improvements and unit re-sequencing as the capabilities become executable. Final production implementation will follow when the package is fully tested and deployed. GDEB plans to fully implement this technology at its Quonset Point Manufacturing Facility, anticipated to be August 2011.

Note: This project is led by the Center for Naval Shipbuilding Technology (CNST) with a portion of the work performed by the Institute for Manufacturing and Sustainment Technologies (iMAST).

Reengineered Pipe Shop Streamlines Processes and Reduce Span Times

S2242-A — Pipe Shop Process Reengineering (CNST)
S2242-B — VCS Pipe Shop Process Reengineering (iMAST)

Objective

This project will identify and classify pipe detail deliverables into specific classes based upon common manufacturing and assembly characteristics. The expressed purpose of this effort will be to design and introduce processes that streamline the planning and manufacturing efforts; and, develop manufacturing process lanes and cellular work centers that are specifically designed to be self-sufficient and support a streamlined product flow through shop. Also included in this project is the development of business rules and algorithms for the discrete sequencing of joint-to-joint pipe fitting. The sequential planning for welding of joints traditionally has been accomplished by the trade mechanic as part of his role as a pipe fitter; the goal is to develop business rules and incorporate these rules into the "work instruction download process" where it will be incorporated into the detail word instructions. As a result of these efforts, span time and all of the associated direct and support costs related to pipe detail and assembly fabrication will be drastically reduced.

Payoff

The current pipe shop processes require a significant reengineering effort in order to meet the increased demands of submarine construction: a construction rate of two ships per year, a 60- month performance requirement and significant reduction in man-hours. This effort will focus on rethinking the current paradigms and develop processes and introduce manufacturing technologies that will transform the pipe shop into a world-class manufacturer of pipe details and assemblies. It is estimated that this project will result in an estimated 3 man-hour savings for each unique pipe detail fabrication in the GDEB pipe shop. With approximately 15K pipe details per VIRGINIA Class submarine (VCS) hull, there is the potential over 45K man-hour savings, resulting in a cost savings of $2.7M per VCS hull.

Implementation

As improvement plans are defined throughout the project, it is expected that pilot implementation will be conducted to demonstrate re-engineered processes and validate change. GDEB anticipates an incremental implementation approach, with efficiencies noted throughout the project's execution. New technologies will be fully implemented into GDEB's Quonset Point Manufacturing Facility processes at appropriate insertion points, with a full implementation expected by August 2011.

Note: This project is led by the Center for Naval Shipbuilding Technology (CNST) with a portion of the work performed by the Institute for Manufacturing and Sustainment Technologies (iMAST).

PERIOD OF PERFORMANCE:

May 2009 to April 2010 (CNST)
August 2008 to December 2010 (iMAST)

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements and Production Engineering

CENTER OF EXCELLENCE:

CNST and iMAST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,066,000

Development of Corrosion Resistant Components Yields $9.4M in Cost Savings

PERIOD OF PERFORMANCE:

October 2008 to October 2010

PLATFORM:

VCS / Submarines

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NMC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$939,000

S2263 — Development of 15-5PH Forgings for Torpedo Muzzle Door Lever Arms

Objective

The torpedo tube muzzle door operating linkage for the Los Angeles (SSN 688) and subsequent classes of Navy submarines include several critical components produced from K-Monel® (Ni-Cu-Al) forgings. The components do not function as needed in a corrosive seawater environment and must be replaced after eight years of service. This project seeks to substitute the K-Monel forgings with 15-5PH steel which provides improved mechanical properties and corrosion resistance, negating the need to replace components during the submarine's lifetime. This project will develop critical forging and heat treating parameters that will result in material properties tailored for this specific application. 15-5PH steel will be evaluated for use on Los Angeles, Ohio, and Seawolf classes of submarines, as well in VIRGINIA Class submarine (VCS) construction.

Payoff

By eliminating the need to periodically replace these critical components in the in-service fleet, the Navy has estimated the cost savings to be approximately $9.4M over the remaining life of these 70 hulls. Material cost savings will also result from replacing K-Monel with 15-5PH forgings in approximately 292 tube linkage assemblies on 70 submarines representing four different classes. In addition, a 60-70% material cost savings is projected in the construction of VCS. 15-5PH steel offers mechanical improvements over K-Monel, including approximately 20-30 ksi yield strength and improved corrosion performance in this application.

Implementation

Upon successful completion of the project, the implementation of the 15-5PH linkage components will begin in VCS new construction, starting in FY11. In addition, retrofit of existing K-Monel linkage components on the Los Angeles, Ohio, and Seawolf classes of submarines will begin in late FY11 after sufficient quantities of machined components are available.

Improved Stainless Cladding Procedures Reduce Rework and Increase Weld Quality

S2270 — Advanced Robotic GMAW Cladding Process Development

Objective

Babcock & Wilcox Nuclear Operations Group (B&W NOG) is the only domestic supplier of large heavy pressure vessels for U.S. Government applications. B&W NOG has had chronic weld quality problems with robotic cladding stainless steel on pressure vessels. These vessels are clad with three layers and then machined. After machining, the cladding is 100% inspected with ultrasonic testing (UT), dye penetrant testing (PT), and visual testing (VT) methods. The Navy Joining Center (NJC) is teaming with B&W NOG to develop controlled dilution, high quality stainless steel cladding procedures that meet Navy specifications using commercially available filler materials and power supplies.

Payoff

Currently, VT- and PT-detected defects are resulting in more than $300K per year in repair costs. These defects are likely due to plasma jet induced porosity from the GMAW process arc. The development of an advanced robotic GMAW process that is resistant to plasma jet induced porosity and provides greater productivity will reduce overall costs.

Implementation

The primary implementation site for this technology is B&W NOG for both VIRGINIA Class and CVN submarines. The project will be conducted with close cooperation and input from B&W NOG. Close interaction with the pressure vessel fabrication facilities of B&W NOG will aid in transitioning the alternate techniques and methods developed under the project in a timely and effective manner. Because the project will entail the identification of techniques suitable for existing processing equipment, as well as processes that may have a significant impact on manufacturing cost but not currently available at B&W NOG, the likelihood of implementation is increased.

Existing robotic capabilities will be used for near-term improvements to decrease the need for further capitalization. It is likely that new GMAW power supplies will be needed. However, existing robotic systems should have the ability to be used with the new power supplies. If potential new processing techniques are identified that provide significant improvements in fabrication efficiency and require capitalization of new equipment, this will be identified relatively early in the project to initiate acquisition plans. In all cases, B&W NOG will have significant input into the process to ensure acceptance of the techniques developed under the project. Several iterations of manufacturing analysis representing increasing accuracy of the manufacturing metrics will be used to determine cost and potential improvements in affordability. Any requirements concerning process modifications or design changes will be identified early in the program and be specifically addressed.

PERIOD OF PERFORMANCE:

April 2009 to March 2011

PLATFORM:

VCS

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements - Metals

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$535,000

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NAVY MANTECH
Manufacturing Technology Program

Marine Corps Projects

Composite Armor Panels Reduce Expeditionary Fighting Vehicle (EFV) Support Costs

PERIOD OF PERFORMANCE:

March 2006 to December 2009

PLATFORM:

Marine Corps

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PM AAA

TOTAL MANTECH INVESTMENT:

$445,000

C2112 — Expeditionary Fighting Vehicle (EFV) Skirt Armor Manufacturing Development

Objective

Skirt armor panels form part of the protection for the Marine Corps Expeditionary Fighting Vehicle (EFV) that is slated to begin low rate initial production (LRIP) in FY12. An enhanced metallic-ceramic composite skirt armor design is being developed for this vehicle. Fabrication of this new design will require much larger panel assemblies than can currently be manufactured. Mechanical fastening is not a viable option due to the additional space claim, weight, part count, and complexity of this type of solution. Therefore, methods must be developed to permit manufacture of the full-sized panels needed for the EFV. The objective of this project is to develop technologies to join armor subpanels to produce panels that make up the EFV armor skirt. A full-scale set of armor skirt panels for one side of the EFV will be joined and delivered to the Navy / Marine Corps for environmental and durability testing.

Payoff

This project will develop a enabling technology for fabrication of large encapsulated armor structures. The performance of these structures is expected to increase the service life of EFV skirt armor from the current 7 years to 14 years. This will result in a reduction in life-cycle support costs for the EFV of approximately $42M based upon an expected order of 1000 vehicles.

Implementation

The results of this project will be implemented through technology transfer to BAE (Advanced Ceramics Division), General Dynamics Amphibious Operations (GDAMS), and General Dynamics Lands Systems (GDLS) in late 2009. It is anticipated that equipment for the joining processes will be commercially available and will be implemented by BAE, GDAMS, GDLS, or an outside supplier.

Friction Stir Welding Improves Performance and Reduces EFV Production Cost

C2152 — Development of Friction Stir Welding for Expeditionary Fighting Vehicle (EFV) Hull Components

Objective

Friction Stir Welding (FSW) of the lower hull assembly of the Expeditionary Fighting Vehicle (EFV) has the potential to improve the mechanical and ballistic performance while reducing the cost of production compared to conventional robotic gas metal arc welding (GMAW). The FSW process has been demonstrated and tested on 2519 aluminum during prior Navy Joining Center (NJC) projects for the Advanced Amphibious Assault Vehicle (AAAV).

A primary task of this project was to develop FSW parameters to join the EFV joint geometries while leveraging the prior ManTech work. This project designed, built, and demonstrated the feasibility of using modular tooling and local clamping to fabricate large structures using FSW. The primary objective of this project was to demonstrate these technologies while delivering a demonstration EFV lower hull assembly for subsequent testing.

Payoff

Implementation of FSW for joining the EFV hull assembly will improve the mechanical and ballistic performance of the structure beyond what is capable with legacy GMAW processes. An improvement of the survivability of the EFV and its impact on the safety of the warfighter is the primary benefit of this program. The FSW process provides a 2x improvement in welding cycle time over conventional GMAW. Based on the current EFV production order of 1,013 vehicles, this represents a cost savings of $1.05M after considering equipment acquisition costs.

Implementation

One of the greatest achievements of this project was the transition of FSW technology to the prime contractor, General Dynamics Land Systems (GDLS). This project was required to demonstrate the feasibility of using FSW for the manufacture of large combat structures. Upon proving this feasibility, GDLS implemented plans for using FSW to fabricate the EFV hull structure including the following actions: complete redesign of the EFV hull assembly to incorporate FSW joint designs in anticipation of the Critical Design Review meeting for SDD-2; the procurement of a large-scale production FSW manufacturing cell to support the EFV (currently being installed at General Dynamics' Lima, Ohio facility with an machine runoff in 2009); and the decision to implement this technology into the SDD-2 vehicles scheduled for manufacture between FY09 to FY12.

PERIOD OF PERFORMANCE:

August 2006 to June 2009

PLATFORM:

Marine Corps

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Metals

CENTER OF EXCELLENCE:

NJC

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STAKEHOLDER:

PM AAA

TOTAL MANTECH INVESTMENT:

$749,000

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NAVAIR Projects
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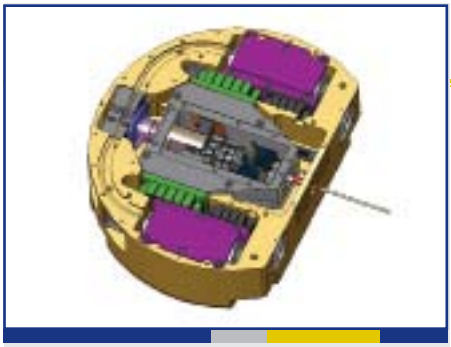
NAVY MANTECH
Manufacturing Technology Program

NAVAIR Projects

Novel Approaches in Mid-Infrared Laser Technology Allow for Size and Weight Reductions



PERIOD OF PERFORMANCE:

January 2007 to
December 2009

PLATFORM:

NAVAIR

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

EOC

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STAKEHOLDER:

PMA 272

TOTAL MANTECH INVESTMENT:

$2,881,000

A2115 — Multispectral Mid IR Lasers for Directional IR Countermeasures

Objective

Advanced Man Portable Air Defense Systems (MANPADS) are a current and ongoing threat to helicopter, tactical aircraft, and commercial airliners. Mid-Infrared laser-based infrared countermeasure (IRCM) systems, such as the Army's Advanced Infrared Countermeasures (ATIRCM), could provide state-of-the-art MANPADS protection for the helicopters, but, due to the system's prohibitively high cost, it is limited to Special Forces applications only. As such, the majority of the rotary wing fleet is unprotected from advanced MANPADS. Current DIRCM systems typically use lasers which require good thermal management systems to remove excess heat which add to the overall power consumption and size of the device. While these devices have proven successful in countering MANPAD threats, their size, weight, and cost of the device makes them difficult to employ on small military aircraft as well as commercial planes.

The objectives of this project are to develop the manufacturing technology to address laser manufacturing issues for critical near-term programs such as PMA 272's Strike (F/A 18) and Assault (helo) DIRCM Programs. The technical approach addresses issues such as a reduction in size, improvement in the yield of critical components and subsystems, and a decrease in cost. This may be accomplished by improving the technology, methodology, or materials for the designs currently in use or under development, developing key components and materials, and incorporating pilot production runs to validate technological approaches.

Payoff

Current mid IR lasers for DIRCM applications typically have limitations resulting from their use of nonlinear wavelength converters that require good thermal management that can add to the power consumption, size, and weight of the subsystem. These lasers are also limited in the wavelength range they can emit as well as their output power levels that can make them unsuitable for current DIRCM systems. Using novel approaches in mid IR laser development, a reduction in size and weight of the DIRCM laser transmitter subsystem can be realized while improving the wavelength and power requirements necessary for next generation DIRCM system.

Implementation

Lightweight, low cost mid IR lasers for DIRCM systems are applicable for any aircraft requiring protection against MANPADS threats. PMA 272's Strike and Assault DIRCM programs require mid IR laser subsystems that are both lightweight and low cost so they can be deployed on smaller aircraft. The subcontractor on this effort has extensive experience in current mid IR laser development and a novel technical approach to address the mechanical, electrical, and performance requirements of the Strike and Assault DIRCM programs. Platform insertion is planned as follows: AH-1W - Cobra assault helicopter – 2010; AH-1Z - Cobra – 2010; SH-60 Seahawk – 2010; and F/A 18 – 2012.

Maturing Radome Fabrication Processes to Result in Reduced Cost

A2202 — Asymmetric Radome Manufacturing Technology

Objective

The objective of this ManTech project is to make advanced radome designs affordable by refining and maturing the manufacturing processes for radome fabrication while maintaining part quality and performance. This project will address the affordability issues associated with materials selection, recurring manufacturing processing costs, as well as quality controls. As a minimum, acquisition and producibility costs will be addressed, including procurement of materials, processing techniques, hand lay-up procedures, laminate configuration, sandwich core construction, and tooling methodology.

Payoff

The principal benefit of this project is the generation of manufacturing solutions for the production of an affordable asymmetric radome design for the EA-18G Wing Tip Pod (WTP). Additional benefit includes an improved direction finding (DF) capability through a reduction in the Insertion Phase Delay (IPD). Reduction in the insertion Phase Delay will be due in part to the asymmetric design and manufacturing techniques developed to allow affordable production of the asymmetry. Cost benefits are estimated from known material costs and projected manufacturing recurring hours based on the fabrication of demonstration articles. It is expected that this project will result in the lowering of radome acquisition cost by over $4K per unit and approximately $16K per aircraft (4 units per aircraft). This will be accomplished by employing materials and processing options that can reduce addressable manufacturing costs and reduce unit scrap rates while maintaining performance requirements. The processes may be usable for other radome applications as well. With an approximate ManTech investment of $1.05M and savings from 60 aircraft (240 radomes), a savings of $0.96M, results in an ROI of 0.91. Considering the investment to qualify new radomes of approximately $0.60K, the ROI is reduced to 0.58.

Implementation

Implementation of the EA-18G Wing Tip Pod Asymmetric Radome will not be occurring at this time due to a reduction in ROI. In addition, there is an increased risk to the EA-18G by implementing a new technology without the need for improved DF capability. Two prototype radomes will be built and fully RF characterized per request from the EA-18G Program Office. Once proven as potential solutions, the Program Office will set them aside for future consideration should improvements be required of the current WTP Radomes whether it is through the use of the improved manufacturing technology or the improved performance capability of the asymmetric radome. In spite of this, much of the work can be leveraged on other programs. The NGC BAMS program office has been briefed on the findings of this program and is now considering a PEI Foam / Quartz Epoxy Radome. The current PMI foam is creating significant manufacturing challenges related to the high moisture absorption properties of PMI. In addition, the use of Epoxy in radomes has been proven to be a viable option as opposed to the far more expensive Cyanate Ester currently used.

PERIOD OF PERFORMANCE:

June 2008 to October 2009

PLATFORM:

NAVAIR

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Composites

CENTER OF EXCELLENCE:

CMTC

POINT OF CONTACT:

Mr. Charlie Rowe
(864) 646-4516
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STAKEHOLDER:

PMS 265

TOTAL MANTECH INVESTMENT:

$1,048,000

Optimized Composites Manufacturing for Wing Skins to Result in Reduced Scrap and Rework

PERIOD OF PERFORMANCE:

June 2008 to December 2009

PLATFORM:

NAVAIR

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Composites

CENTER OF EXCELLENCE:

CMTC

POINT OF CONTACT:

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(864) 646-4516
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STAKEHOLDER:

PMA 265

TOTAL MANTECH INVESTMENT:

$1,500,000

A2234 — Affordable F/A-18 Wing Skin Manufacturing

Objective

F/A-18E/F wing skin production is experiencing continuing manufacturing issues related to ply waviness associated with cocured wing access cut-out steps, also known as rabbets. These issues have resulted in undesirably high scrap rates which have at times threatened aircraft delivery schedules. Two near-term manufacturing technologies have the potential to solve the F/A-18E/F ply distortion quality issues. These are: (1) staging 2 to 4 of the composite plies directly under the rabbet step prior to part cure and (2) die-stamp cutting of the ply-stack which terminates at the rabbet step. After a down selection, technology 1 proved to be the most viable.

These near-term manufacturing solutions are very desirable for the F/A-18E/F program because they can be fully developed in the 2008 - 2009 timeframe and implemented into production with a minimum of structural verification testing, thus enabling a rapid resolution to the program's on-going ply distortion quality issues. The project objective is to investigate the two near-term manufacturing technologies to prevent rabbet ply distortion, ply staging, and multi-ply stack stamping, then down-select to the optimum technology for the F/A-18E/F wing skins, and fully demonstrate production capability.

Payoff

Primary benefits are wing skins with reduced scrap, disposition, and rework costs. Additionally there would be operation and support (O & S) cost savings to the fleet. The Return on Investment (ROI) is estimated to be about 5 based on a rough order of magnitude (ROM) cost analysis performed. This ROM estimate was based on 40 aircraft per year, 4 upper wing skins per aircraft, a 10% upper wing skin scrap rate, a 30% part disposition rate, $40K per skin cost, $10K disposition cost, and a three year timeframe.

Implementation

The project will fabricate and test a DD62 wing skin article to demonstrate acceptable wing skin fabrication with the improved processes established in the program. There will be detailed manufacturing planning changes, including possible process specification modifications and drawing changes depending on the selected technologies. These activities will be conducted in parallel with the ManTech project with associated costs taken care of by the F/A-18E/F Program and part manufacturer. Resulting technology is expected to be implemented into the production line in late 2009.

Improved Process to Reduce Cost of BMI Fiber Placement

A2267 — Improved BMI Fiber Placement

Objective

The Joint Strike Fighter (JSF) utilizes bismaleimide (BMI) as its primary structural material due to the operating environment of the Marine Corps STOVL aircraft and the weight challenges from both the Marine Corps and Navy CV aircraft variants (use of BMI saves weight over epoxy). The fiber placement process was adopted for many of the large wing structural components for affordability reasons. Fiber placement of BMI has posed numerous challenges to the JSF program and its supply base. The difficulty with being able to consistently fiber place BMI parts has the potential to adversely impact the affordability of the program. In order to meet the programs' "Unit Recurring Flyway" (URF) cost objectives, the JSF supply base needs to be able to consistently fiber place BMI wing parts at "epoxy like" rates.

The objective of this project is to consistently lay down BMI at "epoxy like" rates through developing an understanding of how the material, machine / equipment, process parameters and manufacturing environment interact to effect BMI fiber placement. These factors all contribute to the ability to effectively fiber place parts. While they have been understood and optimized over the years for epoxy materials, very little efforts have been made using BMI materials. A dedicated effort that involves the JSF material supplier (CYTEC), the fiber placement machine company with the largest installed base and the preferred supplier for JSF equipment (MAG Cincinnati), and a part fabricator (HITCO) will be undertaken to understand and optimize all the factors that affect BMI fiber placement processing. Trials will be conducted using JSF approved materials (IM7/5250-4 slit tape) with a representative lower wing skin geometry and ply layup.

Payoff

The cost savings per aircraft is anticipated to be $37.5K. Assuming 623 aircraft, the resulting ROI is 6:1. It should be noted that the savings only accounts for Navy and Marine Corp aircraft purchased beginning at Low Rate Initial Production (LRIP) 5. If the total JSF planned buy (includes USAF and Partner purchases) is taken into consideration, the savings number and ROI will be much higher. The cost savings estimate will be refined as the project progresses.

Implementation

The implementation of Improved BMI Fiber Placement is dependent on the successful completion of fiber placement lay-up activities involving material, machine, processing conditions, and manufacturing environment activities to assure the improved process meets fit, form, and function of the baseline article while increasing the lay down rates. Once the optimum parameters to achieve improved lay down are defined and verified on the ManTech project, the F-35 Materials and Processes organization led by Lockheed Martin will make the necessary updates to the specifications and process planning documents as required. The target for full implementation on the F-35 Program is LRIP 5 in 2012 however as the improved process parameters are validated they will be immediately passed on to the JSF supply base so we expect to see improvements beginning as soon as late 2010 during LRIP 4.

PERIOD OF PERFORMANCE:

March 2009 to December 2010

PLATFORM:

NAVAIR

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements – Composites

CENTER OF EXCELLENCE:

CMTC

POINT OF CONTACT:

Mr. Charlie Rowe
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charlie.rowe@scra.org

STAKEHOLDER:

Joint Strike Fighter

TOTAL MANTECH INVESTMENT:

$4,049,000

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Energetics Projects
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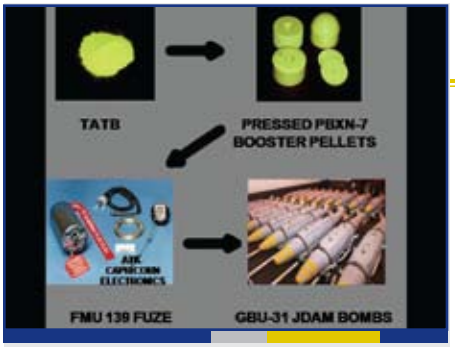
NAVY MANTECH
Manufacturing Technology Program

Energetics Projects

Manufacturing Options to Resolve Sensitivity Issues with Current Domestically Produced TATB



PERIOD OF PERFORMANCE:

September 2009 to December 2010

PLATFORM:

Energetics

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

EMTC

POINT OF CONTACT:

Mr. Charles R. Painter
(301) 744-6772

STAKEHOLDER:

PMA 201

TOTAL MANTECH INVESTMENT:

$3,485,000

A0983-2 — Alternative Manufacture of Energetic Material TATB Phase 2

Objective

Triamino-trinitrobenzene (TATB) is one of the least sensitive explosive materials known and is a primary, critical ingredient used to meet Insensitive Munitions (IM) requirements in the booster explosive PBXN-7, used in bomb and missile fuzes. All U.S. sources for this material have ceased production, primarily due to demand and environmental issues with the current manufacturing routes. The demand for TATB/PBXN-7 soared when the Navy began to re-booster over 80,000 FMU-139 bomb fuzes. The objectives of this project are to investigate and evaluate several alternative TATB chemical synthesis processes, determine the best approach, scale-up, and demonstrate the process at full production scale.

Payoff

This project culminated in a demonstrated, domestic manufacturing capability at ATK Launch Systems at the 500-gallon production scale. Subsequent to the start of the ManTech project, BAE Systems, Ordnance Systems Incorporated (OSI), contract operator of the Holston Army Ammunition Plant, independently had success in developing another synthesis route to manufacture TATB. During the qualification testing, the ATK and BAE TATB were determined not to be suitable as a "drop in replacement" for TATB in the PBXN-7 formulation.

Implementation

The Office under the Secretary of Defense Acquisition, Technology and Logistics, Land Warfare and Munitions OUSD (AT&L) LW&M established a DOD / DOE Joint Integrated Program Team to determine a path forward to establish a CONUS supplier for TATB. The Integrated Project Team (IPT) recommendation was to facilitate Holston Army Ammunition Plant (HSAAP), Kingsport, TN and Radford Army Ammunition Plant (RFAAP), Radford, VA to manufacture TATB using the legacy Benziger synthesis route. A Memorandum of Agreement (MOA) has been executed between DOD and DOE National Nuclear Security Agency (NNSA). The Agreement establishes a cooperative program to ensure DOD's short term TATB requirements are met and establishes detailed plans for process development and for facilitization of a CONUS industrial base supply capability for production of TATB. Process development work is scheduled to be complete in 1Q11. Requalification of the PBXN-7 is scheduled in FY12. TATB is needed to sustain current acquisition programs for FMU-139 and FMU-152 fuzes used in Navy and Air Force bombs (BLU-110, BLU-111, BLU-113, BLU-117, BLU-126, MK82, and MK84). Other users of PBXN-7 include FMU-143 (BLU-116, BLU-109), FMU-148A/B (Tomahawk), FMU-155/B (SLAM ER), MK436 fuze (MK146 warhead 2.75) and JSOW. TATB is also a primary component in IM fuze booster PBXW-14 in the M734A1 fuze for the Army (and USMC) M934 120-mm mortar.

Production of High Nitrogen Gun Propellants Using Twin Screw Extrusion

S0984 — Flexible Manufacturing of Nitrogen Based Gun Propellants (Flex Man)

Objective

Continuous processing is a revolutionary lower-cost technology being used for the manufacture of gun propellants and other energetic materials. Navy systems such as the extended range conventional 5-inch round and the Advanced Gun System (AGS) require higher-performing gun propellants to increase stand-off range and to engage targets further inland. Novel propellant formulations and geometries, such as propellants that include high nitrogen ingredients and co-layered propellants, have the potential to offer this higher performance while also decreasing gun barrel erosion and improving munition insensitivity. The objective of this project is the development of a continuous process to manufacture low cost, high volume nitrogen-based gun propellants, including a co-extrusion process for the manufacture of co-layered propellants.

Payoff

The primary focus is to establish the manufacturing capability to produce energetics using continuous extrusion processes. As an added benefit, cost avoidances of approximately 25% are historically realized when switching from conventional batch processes to a continuous extrusion process. Operating efficiency is obtained by replacing numerous labor-intensive operations of the batch process with a single automated process. Lower environmental costs are derived from reducing explosive waste and eliminating waste solvents. Enhanced operator safety is realized because the continuous process incorporates remote and automatic control. Improved reliability results from better dimensional control of the propellant and improved product quality.

Implementation

The process development and demonstration for the co-layered configuration has been completed and the remaining configurations will be completed at Naval Surface Warfare Center, Indian Head Division (NSWCIHD) by late 2010. This technology has the potential to be implemented for Navy programs being developed in parallel with the project such as an extended range conventional 5-inch round, the High Energy BB round, and the Extended Range Long Range Land Attack Projectile (ER-LRLAP) for AGS. The Extended Range Munition (ERM) Program is in the process of being restructured, so qualification and production dates are unknown at this time, but the technology will be available when those dates are determined. After a successful demonstration, the process will be transitioned to an energetics manufacturer. If a willing industrial source cannot be found, Naval Surface Warfare Center - Indian Head Division (NSWC-IHD) will implement this technology into production.

PERIOD OF PERFORMANCE:

April 2001 to October 2010

PLATFORM:

Energetics

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

EMTC

POINT OF CONTACT:

Mr. Charles R. Painter
(301) 744-6772

STAKEHOLDER:

PEO (IWS)

TOTAL MANTECH INVESTMENT:

$6,819,000

Real-Time Analytical Tools Optimized Process Scale-up of Novel Energetic Materials

PERIOD OF PERFORMANCE:

June 2006 to March 2010

PLATFORM:

Energetics

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

EMTC

POINT OF CONTACT:

Mr. Charles R. Painter
(301) 744-6772

STAKEHOLDER:

PEO (IWS)

TOTAL MANTECH INVESTMENT:

$3,554,000

S2214 — Flexible Manufacturing of Novel Energetic Materials (Flex NEM)

Objective

The Energetic Material community continues to develop new molecules that address specific fleet requirements. In order to properly evaluate these novel ingredients in formulations, appropriate methods are employed to produce sufficient quantities of these ingredients and subsequent formulations. If a material affords favorable characteristics a commercial manufacturing route is developed. At this time, it is appropriate to demonstrate viable commercial routes to the energetic materials. The Navy has invested in tools that allow in-situ monitoring of chemical reactions, crystallizations and other unit operations associated with the manufacture of energetic ingredients. The data generated allows for the design and development of various manufacturing equipment designs including continuous processes. Kinetic and heat flow data is used to properly size reactors and its ancillary equipment. These tools have resulted in several commercial routes to novel ingredients including triaminoguanidinium azotetrazolate (TAGZT) and guanidinium azotetrazolate (GUZT) for use in gun propellants. These ingredients were produced on multi-kg scale and demonstrated in energetic formulations for gun propellants.

Payoff

The ability to quickly and efficiently scale-up novel ingredients allows the development of energetic formulations. The novel ingredients are highly regarded in the formulation community as they provide alternative formulations with high energy, while minimizing erosion of the gun barrels. Real-time analytical tools aid in producing these novel materials at the multi-kilogram scale to support research and development formulation efforts and are easing the transition from development to production. Based on the use of these tools, synthesis modifications can be incorporated to lower manufacturing costs by improving operating efficiency and enhancing safety. The use of automation also reduces human error as well as removes the operator from a hazardous environment. Optimizing the synthesis process will reduce labor cost as more GUZT is produced per batch. The overall cost avoidance is based on reduced labor requirements, increased product yields and quantities, reduced explosive waste, and improved product quality. The increased capabilities afford a more efficient, advanced manufacturing process for GUZT.

Implementation

The process will be ready for testing at the 500-gallon scale in FY11. At this time, the intent is to solicit industry partners for interest in manufacturing GUZT at their respective facilities. In FY10, a design will be completed to incorporate 500-gallon reactors equipped with in-situ monitoring tools. A technical data package will also be provided to Navy ManTech for transition of the process to any interested industry partner in support of Advanced Gun Propellants. If a willing industrial source cannot be found, Naval Surface Warfare Center - Indian Head Division (NSWC-IHD) will implement this technology into production. This technology is planned for Navy programs such as an extended range conventional 5-inch round and the Extended Range Long Range Land Attack Projectile (ER-LRLAP) for Advanced Gun Systems (AGS).

REPTECH Projects
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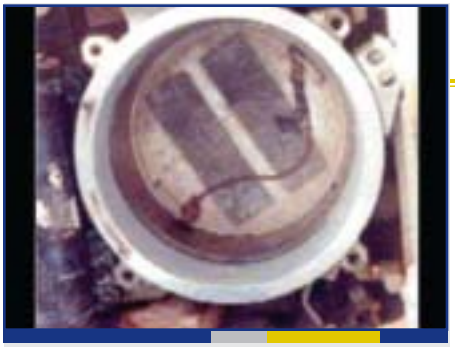
NAVY MANTECH
Manufacturing Technology Program

REPTECH Projects

Laser-Based Repair Reduces Life-Cycle Cost and Optimizes Operational Readiness of Submarines



S0994 — VLS Tube Repair

Objective

Vertical Launch Systems (VLS) on 688 Class submarines are experiencing corrosion damage in Vertical Launch Missile tube areas. This affects both the weapon system's availability during deployment and maintenance costs pierside. Severe corrosion can result in missile tubes placed out of service until the vessel returns to port. At a minimum, this corrosion damage is resulting in an increased maintenance burden with significant repair costs. The objective of this project was to qualify a laser cladding process to apply a superior method of corrosion protection to the affected VLS tube areas using technology developed at the Applied Research Laboratory (ARL) at Penn State University.

Payoff

Benefits of the laser cladding process include a 62.5% reduction in repair time and an increase in durability to a level equivalent or better than the originally delivered tubes. A laser-based repair will decrease repair costs by reducing the labor necessary to accomplish a repair and by extending the time between repairs. Operational readiness and weapon system reliability will be optimized by this improved process while reducing life-cycle costs. Each submarine has 12 VLS tubes. Assuming shipyard worker direct time to amount to $100 per hour, the cost avoidance per tube will be $18K for a total of $216K per sub. Seventeen subs in the Pacific Fleet will benefit from VLS tube recladding in the next five years, according to schedule availabilities, for a total cost avoidance of over $3.6M.

Implementation

The system was delivered to Pearl Harbor Naval Shipyard (PHNSY) and Intermediate Maintenance Activity in August 2009. The system delivered to PHNSY is an automated tool that will prep, weld, and grind the VLS seal band area. The Institute for Manufacturing and Sustainment Technologies (iMAST) has established and reported baseline corrosion data to guide the selection of repair material. SEA 05 approval procedures have been established as a supplement to MIL-STD-248 pending any necessary further approval. The VLS Cladding Procedure test plan was conducted by PHNSY Artisans and the results submitted, via PHNSY management, to NAVSEA 05 requesting certification approval. Regular team meetings are held with formal program reviews to keep the implementation on track. Until certified by SEA 05, the system is operational and available for training purposes with the supplied mock-up system that accompanied the laser cladding system. Current certification goals are to support the USS Chicago's (SSN 721) engineered overhaul (EOH) at PHNSY.

PERIOD OF PERFORMANCE:

December 2000 to
December 2008

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

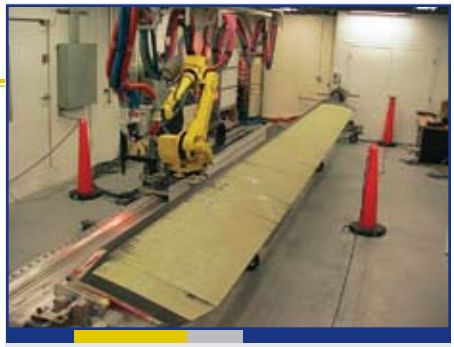
COMSUBPAC
NAVSEA (SEA 04X2E)
NAVSHIPYD – Pearl Harbor

TOTAL MANTECH INVESTMENT:

$1,575,000

Automated Rotor Blade Stripping System (ARBSS) Installed at Fleet Readiness Center East

A1014 — Helicopter Blade Refurbishment



Objective

Current blade stripping procedures are labor-intensive, time-consuming, and expensive. The objective of this project was to analyze available refurbishment methods, select an optimal cost-effective technology process, and help implement the designated process for application on Sikorsky CH-53E helicopter main rotor blades inducted at Fleet Readiness Center - East (FRC-CP) in Cherry Point, NC. Laser-based coating removal (LBCR) technology has been demonstrated as a viable, environmentally friendly alternative to conventional depainting techniques. Testing, in accordance with Sikorsky Aircraft specifications, indicates no damage to the substrate will occur from the laser stripping process when using the real-time sensor feedback for substrate protection. The stripping head by General Lasertronics Corporation has been integrated into a complete system by Naval Undersea Warfare Center (NUWC) Keyport. The system was accepted for use at FRC East in April 2009 and was installed at the depot in June 2009.

Payoff

The successful completion of this project will result in a viable cost-avoidance and will improve blade refurbishment throughput. It will also have a beneficial environmental impact on worker health and safety. The qualification of a laser stripping process by an original equipment manufacturer (OEM)-approved technology will ultimately result in an estimated reduction in processing time from 20 hours per blade to less than two hours per blade (a 90% reduction). A cost avoidance of approximately $908K per year is anticipated.

Implementation

After successfully proving the new process is cost-effective and meets requirements established by the Naval Air Systems Command (NAVAIR), the Institute for Manufacturing and Sustainment Technologies (iMAST) has worked closely with the system integrator and FRC-CP personnel to design a system that accommodates production flow. Process Qualification Testing and local FST Process Approval was successfully completed at NUWC Keyport in April 2008. Functional testing of the automated rotor blade depainting system has been conducted. The system was accepted for use at FRC-CP in April 2009 and was installed at the depot in June 2009. Working with the National Center for Manufacturing Sciences / Commercial Technology for Maintenance Activities (NCMS / CTMA) team members (Sikorsky, General Lasertronics Corporation, Naval NUWC Keyport, and Koops System Integrators) has added valuable technical guidance, financial support, and eventual commercial suppliers for the technology transition.

PERIOD OF PERFORMANCE:

June 2002 to August 2009

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

Fleet Readiness Center East
FRC-CP (Cherry Point)

TOTAL MANTECH INVESTMENT:

$833,000

Erosion Resistant Coatings Avoid Costs and Improve Service Life of Aircraft Compressors

PERIOD OF PERFORMANCE:

April 2005 to September 2009

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

NAVAIR

TOTAL MANTECH INVESTMENT:

$1,650,000

A2087 — Erosion Resistant Coatings for Stage 1 Compressor Components

Objective

When aircraft take off and land, vortexes are formed which often result in the ingestion of hard solid particles of sand, dust, and ice into the air flow. First stage compressor components of T700 helicopter engines exhibit leading edge curl damage believed to be associated with high angle (60-90 degrees) and large particle impingement of erosive media. Decreased service life and increased maintenance costs occur as the realized time-of-flight is only half of that expected (2,500 hours vs. 5,000 hours). In some aggressive environments (like Iraq and Afghanistan), only about 100 hours of flight time (50 times less than expected) are achieved before significant maintenance is required to return the aircraft to flying status. The objective of this project was to better understand the leading edge curl phenomena, identify a duplex erosion resistant coating that survives high angle impingement of erosive media, and develop a manufacturing method / process for applying duplex or multi-layer erosion resistant coatings with improved erosion resistance over a wide range of large (>1mm) particle impingement angles (20-90 degrees).

Payoff

The anticipated cost avoidance for the SH-60B, SH-60F, and HH-60H helicopters was calculated based on the total number of engine removals to be avoided due to increase in mean time since engine removal associated with the improved configuration. Over a ten year period, the total cost avoidance is anticipated to be $20.5M.

Implementation

The final project goal is applying erosion resistant coating system to first stage compressor blisk (i.e., prototype hardware) for testing at Naval Air Systems Command (NAVAIR) in an erosion rig. The performance goal of the coated prototype hardware is a minimum of 1000 hours of operation or a minimum improvement of 2x measured by time-on-wing. If the performance goal is met, Applied Research Laboratory (ARL) at Penn State University will continue to work with NAVAIR and MDS-PRAD Technologies to qualify the material system, manufacturing process and coated hardware. MDS-PRAD has significant prior experience with implementing coatings for T58 and T64 helicopter engines. This project is assisting in establishing the manufacturing capability to apply coatings to T700 engine blisks.

Cold Spray Aluminum Coating Provides Corrosion Protection

A2138 — Corrosion Resistant Coatings for Magnesium Transmission Gear Boxes for SH-60

Objective

Main gearbox transmission housings are made of cast ZE 41 magnesium alloy. During operation, the magnesium alloy is subject to corrosion and wear damage. When damage reaches critical levels, the component must be replaced with a new component. The objective of this effort is to apply corrosion resistance aluminum coatings to damaged components and return them to service with enhanced corrosion resistance. The repair process was based on High Velocity Particle Consolidation (HVPC) or Cold Spray (CS).

Payoff

It is estimated that approximately 33% of the transmission housings that have gone through the repair facility have been replaced due to severe corrosion damage. The average cost of replacement is $20K per component, leading to total annual replacement cost expenditures of $4M. Approximately 60% of the scrapped housings can be recovered using the CS repair process. The cost of applying a coating to a housing is estimated to be $500. Anticipated cost avoidance is $2.34M per year. The repair of transmission housings will increase readiness by extending the life of the housings and reducing maintenance / replacement costs.

Implementation

Implementation will be accomplished at the Fleet Readiness Center (FRC) East at Cherry Point, NC. A coating system has been purchased through the Environmental Security Technology Certification Program (ESTPC). The system was installed and qualified in May 2009. The process for coating the SH-60 transmission housings will be fully transitioned to FRC East personnel in April 2010.

PERIOD OF PERFORMANCE:

May 2006 to April 2010

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

NAVAIR

TOTAL MANTECH INVESTMENT:

$767,000

Paint Application System to Increase Transfer Efficiency to 95% or Greater

PERIOD OF PERFORMANCE:

October 2006 to
September 2010

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

NAVAIR
MARCOR
NAVSEA

TOTAL MANTECH INVESTMENT:

$350,000

S2176 — Effervescent Paint Application System

Objective

The application of maintenance coatings to ships, submarines, tanks, and other weapon systems is performed almost exclusively using the airless paint spray process. The transfer efficiency of the airless paint spray process is dependent upon a variety of factors but is generally accepted as being within the range of 40%-60%. Transfer efficiency is the ratio of coating solids deposited on a substrate to the total weight of coatings solids used in the coating application step, expressed as a percentage. The primary source of material loss during the airless paint spray process is due to overspray. The goal of this project is to develop a paint application system to significantly reduce or eliminate overspray from industrial processes and thereby increase transfer efficiency to 95% or greater. The process developed will be a paint spray application system having transfer efficiency in excess of 95%. This technology has been proven feasible through work performed at Applied Research Laboratory (ARL) at Penn State University.

Payoff

Reducing or eliminating overspray from these industrial processes will have the following beneficial outcomes: reduce material usage and the associated (potentially hazardous) waste streams; reduce volatile organic compounds (VOC) usage and accidental release of copper particulates during hull-maintenance activities; and reduce cleanup costs associated with paint overspray. The cost benefit analysis based on a single medium-sized shipyard using approximately 30,000 gallons of paint per year in the building and repair of ships results in estimated cost avoidance (materials and car detailing) of almost $600K.

Implementation

The prototype industrial paint spray system will be demonstrated at the Puget Sound Naval Shipyard in the 2nd or 3rd quarter of FY10. Following successful demonstration, the commercial paint system configuration will be finalized and a production unit will be fabricated. Once the final production unit has been tested and validated, implementation will proceed. Pollution Abatement Ashore (PAA) funding is being sought for implementation. Ample testing will be performed to identify reduction of overspray volume / improved material usage for various MIL-SPEC coatings. This spray system will operate and function in a similar manner to current airless spray systems. The only differences will be a reduction in overspray, improved material usage, reduction in cleanup costs, and reduced environmental impact. This spray application technology does not modify or alter the chemistry or physical properties of the materials being processed. For these reasons, no changes to specifications, standards, process instructions, etc. will be required. Implementation of this technology at DOD maintenance facilities other than Puget Sound Naval Shipyard will be accomplished through the simple expedient of purchasing a spray system, and applying current MIL-SPEC coatings to current weapon systems and support equipment.

Blade Repair and Inspection Process Saves At Least $500K Per Year

A2177 — F402 Compressor Blade Repair

Objective

The project objective is to evaluate and implement a mature additive repair process and non-destructive inspection technique for the repair of high pressure compressor (HPC) blade tips in the AV-8B Harrier's F402 engine.

Payoff

The primary payoff is cost avoidance by repairing worn blade tips instead of replacing them. In addition, the original equipment manufacturer (OEM) of new blades has indicated that the Navy's demand for new blades will not be met due to manufacturing issues. The repair and inspection process will increase the operational fleet size and save up to $579K per year in operational costs associated with replacing blades. A successful repair process will impact other aero-engine systems such as the T700 and F-18.

Implementation

The outcome of this project will be a repair and inspection process for HPC blade tips that provides flight assurance to the F402 Fleet Support Team (FST) and Fleet Readiness Center (FRC)-East, while reducing life-cycle maintenance costs and mitigating a future supply chain crisis. Implementation is achieved when (1) FRC-East acquires the equipment necessary to perform the repair and inspection process, (2) FRC-East produces qualification test samples according to the ManTech-developed Pilot Qualification Plan, and (3) the F402-FST and PMA 257 qualify the repair and inspection process. Final implementation is expected to occur in early FY12.

PERIOD OF PERFORMANCE:

March 2007 to
September 2009

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

POINT OF CONTACT:

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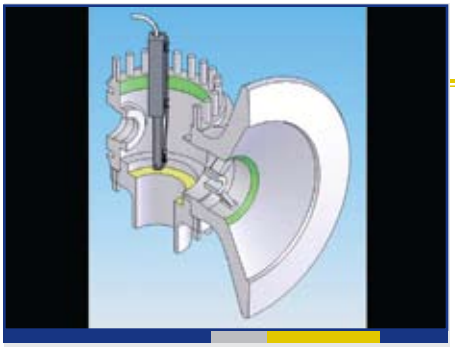
STAKEHOLDER:

PMA 257

TOTAL MANTECH INVESTMENT:

$500,000

Novel Wire-Based, Deep-Bore Laser Clad Head Will Enable Shipboard Valve Repairs



S2178 — In-Situ Strategic Repair Process

PERIOD OF PERFORMANCE:

May 2007 to June 2010

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

POINT OF CONTACT:

Mr. Timothy D. Bair
(814) 863-3880
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STAKEHOLDER:

NAVSEA
Pearl Harbor Naval Shipyard (PHNSY)
NUWC Keyport

TOTAL MANTECH INVESTMENT:

$900,000

Objective

In many cases, significant cost savings can be realized if long-lasting component repairs can be executed on the ship or in the field. The goal of this effort is to develop and implement technologies that enable in-situ or field repair of various components for the Navy and other services. The primary short-term objective is to develop and implement in-situ clad repair tools and methodologies for main seawater (MSW) / auxiliary seawater (ASW) hull and back-up valves. This will be realized by developing a simple, flexible approach to clad repair that keeps the man-in-the-loop where appropriate and utilizes mechanization when justified. Development of such flexible techniques will pave the way for this technology to address a broader range of needs within the repair community. The strategy has been formulated based on feedback from the REPTECH Working Group, the Naval Undersea Warfare Center (NUWC) - Keyport, and Pearl Harbor Naval Shipyard (PHNSY). The primary long-term objective is to identify other applications in which in-situ or field repair would result in cost savings, determine if a technology-based solution can help realize these savings and then develop new projects to implement the necessary technology.

Payoff

ASW/MSW valve repairs have been identified as requiring 3,390 man-hours per vessel and were identified by the Navy Executive Planning Sessions as being a "Top Priority Improvement Candidate". Based on a 30% reduction in repair cost, the estimated cost avoidance for the Navy is $1.28M per year.

Implementation

The current plan is to develop a flexible repair tool for in-situ repair of ASW/MSW valves, comprising a man-portable weld head manipulation tool and either a gas tungsten arc weld (GTAW) or wire-based, deep-bore laser cladding head. The plan is to define the problem in detail, develop conceptual flexible tools to address the problem, engineer suitable process heads and clamping systems, build a valve mock-up, and compare various cladding technologies. The system will be suitable for use with the laser recently procured by PHNSY for Vertical Launch System (VLS) Tube Repair. Technical contacts at NUWC - Keyport, PHNSY, Norfolk Navy Shipyard, Portsmouth Naval Shipyard, and Puget Sound Naval Shipyard are engaged in periodic reviews of technical documents and designs. NAVSEA 07 and 05M have also been engaged to determine qualification requirements. Supplemental funding to support design / fabrication of the man-portable manipulation tool has been awarded, and a draft technical specification for this tool has been developed and sent to shipyards for review. A novel wire-based, deep-bore cladding tool has been designed, fabricated, and tested, and is undergoing refinement. Once these tools are successfully demonstrated and evaluated, they will be used to produce qualification parts. Upon qualification, the tools will be implemented at PHNSY and other shipyards.

Submarine Hull Tile Repair to Reduce Time and Cost

S2236 — SHT Repair

Objective

Submarine Hull Tile (SHT) removal is required on almost every submarine dry-docking and pierside repairs. SHT removal is the first operational step conducted on the critical path of submarine hull inspection and repair. The SHT coating removal process is arduous, time-consuming, and difficult. Once major portions of the tile are removed, large chunks of the SHT material and resin residues are left on the submarine. To complete the submarine availability, the SHTs need to be replaced. The replacement process requires a smooth and clean hull to facilitate a good application. The current procedure of using needle-guns and grinders to remove the excess material causes damage to the hull and creates another operation of weld repairs. The objective of this project is to seek or develop, test, and validate optimum SHT installation and removal processes within the scope and capability of the Navy organic processes and to implement this technology in the repair process of submarine SHT tiles.

Payoff

The benefits of the SHT removal process include a payoff greater than 20:1. Assuming one submarine availability per year requires SHT removal, three shipyards conducting SHT repair work at labor rate $100 per hour and hydroblast removal rate of 1 hour per tile using waterjet, the proposed removal process will yield a cost avoidance of $1.6M over the current process.

Implementation

Two separate yet incremental transition events, each at two partner shipyards, are planned. The respective systems at the two partner shipyards will be able to individually assess the two systems for individual decision as well as collective NAVSEA 04XP conclusion. One respective demonstration will be on the West coast – either Puget Sound or Pearl Harbor and the other on the East coast – Norfolk or Portsmouth Naval shipyards. The respective technical assistant at each shipyard attending the demonstration will make the go/no-go decision and clarifications at the end of each demonstration after a thorough analysis of the evaluation criteria.

The tools will be supported throughout the duration of the project for minor revisions. Waterjet cutting has already been approved by NAVSEA 05 as a qualified process for cutting ship materials. It is anticipated that additional features and modifications beyond the scope of those defined in this project would be funded directly by shipyard CPP, NAVSEA 04XP, or other sources.

PERIOD OF PERFORMANCE:

March 2008 to September 2010

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

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STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$396,000

Cladding Procedures Decrease Time Required to Refurbish Propulsion Shafts

S2272 — VCS Propulsion Shaft Clad Repair

PERIOD OF PERFORMANCE:

November 2008 to September 2010

PLATFORM:

REPTECH

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

iMAST

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tdb14@psu.edu

STAKEHOLDER:

PMS 450

TOTAL MANTECH INVESTMENT:

$1,006,000

Objective

The objectives of the VIRGINIA Class submarine (VCS) shaft repair project are to develop laser cladding procedures applicable to both original manufacture and repair and refurbishment of VCS main propulsion shafts. In the repair and refurbishment area, no procedures are currently in place for the refurbishment of the shafts. Laser cladding provides a viable solution for minimizing clad metal dilution and heat input inherent to arc-based processes. Since Pearl Harbor Naval Shipyard (PHNSY) has procured a 4 kW laser system for another project, minimal procurements are required, and the integration of laser cladding into shaft repair leverages this purchase and significantly improves the return on investment for both projects. Specific cost-saving targets for this project include a decrease in the time required to refurbish a shaft (currently two years) and to minimize follow on straightening and machining operations required for the cladding refurbishment of shafts for the Seawolf class.

Payoff

Based on a $75/hour labor rate, the annual labor costs for refurbishment are estimated to be $327K. Taken over an initial five year period at a steady state rate of 6 shafts per year, the projected cost savings over the initial five year period are $1.6M. An annual labor savings of $171K is projected, with a five year savings of $855K. These cost savings are based on calculations for a single shipyard. Similar cost savings would be expected with the addition of systems at other shipyards and do not take into account the significant savings attained through significantly reduced lead times for shaft refurbishment.

Implementation

The Institute for Manufacturing and Sustainment Technologies (iMAST) will team with PHNSY to develop and evaluate laser cladding procedures as an effective and efficient repair for VCS main propulsion shafts. In addition to the development of laser cladding parameters and procedures, iMAST, working with the Naval Undersea Warfare Center - Keyport will design and integrate a laser cladding system to an existing weld positioner at PHNSY. By eliminating these required movements of the shafts, significant cost and schedule savings can be achieved in the refurbishment of shafts. Implementation of the system at PHNSY is currently planned for June 2012.

DOD ManTech
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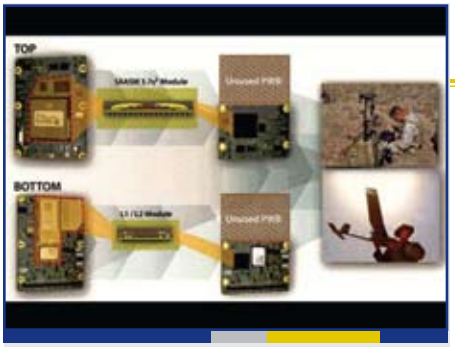
Note: The projects included in this section are Navy-run projects funded not out of the Navy ManTech line but out of the new Manufacturing Science and Technology (MS&T) Program (the DOD ManTech line).

The Defense-wide Manufacturing Science and Technology (MS&T) Program was mandated by Congress in Section 241 of the National Defense Authorization Act of 2006, under the authority of Section 2521 of Title 10, to identify and transition advanced manufacturing processes and technologies that would achieve significant productivity and efficiency gains within the defense industrial base. The program complements the Service and Agency Manufacturing Technology programs by focusing on multi-service DOD priorities which are identified and ranked through roadmapping and data call activities conducted in collaboration with DOD and industry manufacturing representatives.

NAVY MANTECH
Manufacturing Technology Program

DOD ManTech Projects

Advanced Packaging Technologies Enable Smaller, Lighter, Lower Power, and More Rugged GB-GRAM Units



PERIOD OF PERFORMANCE:

May 2008 to August 2010

PLATFORM:

DOD ManTech

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

EMPF

POINT OF CONTACT:

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STAKEHOLDER:

U.S. Army Global Positioning Systems

TOTAL MANTECH INVESTMENT:

$3,255,000

J2251 — Advanced Packaging Technology with Insertion into Defense Systems (APTIDS)

Objective

The Advanced Packaging Technology with Insertion into Defense Systems (APTIDS) project is expected to produce miniaturized Ground Based Global Positioning System Receiver Application Modules (GB-GRAM) units for implementation in military systems. This module demonstrates the application of advanced packaging technologies and techniques in both Radio Frequency (RF) and high speed digital modules to provide SWaP-C (size, weight, power, and cost) solutions for DOD applications. Knowledge and practices gained through the APTIDS project will be provided to the DOD industry, thereby multiplying the benefits of a single project. Advanced packaging technology from the commercial sector will be leveraged to provide solutions to military electronics problems.

Payoff

The main benefits of this project are the provision of smaller, lighter, lower power, and more rugged GB-GRAM modules using advanced flip-chip technologies, micropassive components, high density substrates and interconnections, along with three-dimensional packaging (stacked dies and packages). Size reductions of the GB-GRAM, RF, and Global Positioning System (GPS) modules are anticipated to be 70%, 97%, and 76% respectively. The small, modular design will enable the rapid development and deployment of GPS in a variety of systems. Component standardization offers the potential for high volume GPS components to be used across DOD communications and weapons platforms. Decreases in cost of such systems, accompanied by significant increases in the technical readiness and manufacturing readiness levels, are expected as a result of this project. Improved anti-jam features will also be incorporated into these devices.

Implementation

The technologies developed as a result of this work will have wide ranging applicability to military programs. Under this project, small form factor Global Positioning Receiver and Radio Frequency modules will be developed. These elements will be combined to produce a prototype GB-GRAM module which will be tested to Army GPS specifications and compared to a module fabricated using standard manufacturing technology. At this point, a go / no go decision will be made concerning production at Rockwell Collins. Low Rate Initial Production (LRIP) will then produce GB-GRAM cards for qualification and acceptance of production units by the Army Product Manager. Implementation timeframe for GB-GRAM production is 2011.

Improved Manufacturing of Prosthetics Results in Reduced Cost and Increased Performance for Wounded Soldiers

J2256 — Prosthetics and Orthotics Manufacturing Initiative (POMI) Phase 1

Objective

The realities of the current military engagements are that more soldiers are surviving injuries and living with amputations. The capabilities of our care systems are strained by increased demands. While the current care systems are providing excellent care, there are opportunities to improving processing and manufacturing of prosthetic systems to increase durability and comfort and to give medical personnel tools to aid in the care of injured soldiers. The objective of this project is to dramatically improve the quality and comfort of sockets for lower-extremity prosthetic systems by shifting away from the current experience-based design and production paradigm. This project will leverage the Prosthetics & Orthotics Manufacturing Initiative (POMI) Phase Zero effort allowing intelligent design decisions, informed by both load requirements and soft tissue reactions. With the design in hand, the socket will be produced using an advanced technique developed for the aerospace and defense industries, namely, braiding. This will allow for a socket with spatially-variable properties to be produced with a high degree of automation, and with superior quality, and will also produce sockets strong enough to withstand extreme uses, such as may be experienced by warriors returning to combat.

A second objective of this project is to implement resins developed in other areas into the field of prosthetics to enable local modifications of the composite structure. Traditional resins do not produce a structure which can be modified, mandating either grinding (which can compromise strength and integrity) or the creation of a new socket to affect any shape change. Such changes are often required during the fit process and during use as the residual limb either changes volume or experiences heterotopic ossification (abnormal bone growth).

Payoff

The project will enable prosthetists at military hospitals to produce intelligently designed sockets which will be lighter and more comfortable using automated processes, freeing them to spend more time with patient care and less time with socket production. Sockets will have longer service lives and reduced production and life-cycle costs, (savings are expected to be approximately 25%) this was listed last year. It is expected that the technology will extend socket use to the most extreme patients and activities.

Implementation

Orthotics and prosthetics at Walter Reed Army Medical Center and at other government prosthetics labs will direct the evaluation and implementation of these technologies. They will also have the opportunity to evaluate and purchase additional systems. For full implementation, the system will need to be used in a clinical setting to compare the efficacy of the new system versus traditional manufacturing. Decisions regarding comfort and costs will need to be made based upon a large data set which cannot be obtained any other way. Only some components (sensoring materials for sockets, advanced resins, materials for producing sockets via braiding) will be consumed during use and will need to be purchased in order to make continual use of the system. The goal is to produce sockets at reduced costs compared to the traditional manufacturing method, such that the cost of implementation will result in a cost savings. Implementation may occur as early as August of 2010 with a demonstration at Walter Reed.

PERIOD OF PERFORMANCE:

August 2008 to August 2010

PLATFORM:

DOD ManTech

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

CMTC

POINT OF CONTACT:

Mr. Charlie Rowe
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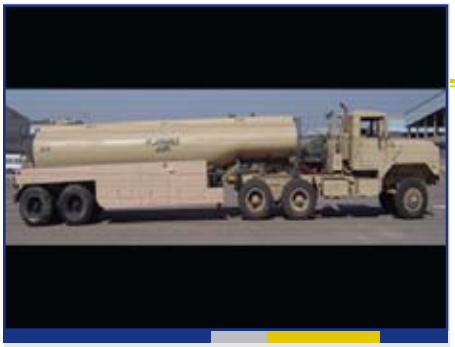
STAKEHOLDER:

Walter Reed Army Medical Center

TOTAL MANTECH INVESTMENT:

$2,900,000

Automated Spray Process Improves Production and Reduces Cost



PERIOD OF PERFORMANCE:

February 2009 to December 2009

PLATFORM:

DOD ManTech

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

CMTC

POINT OF CONTACT:

Mr. Charlie Rowe
(864) 646-4516
charlie.rowe@scra.org

STAKEHOLDER:

JDMTP

TOTAL MANTECH INVESTMENT:

$300,000

J2257 — Ballistic Protection for Gasoline Tanker Trucks

Objective

BattleJacket™ is a self-sealing and self-healing coating technology that protects gasoline tanker trucks and fuel tanks by stopping leaks, as well as the inherent fires and explosions caused when bullets or bomb fragments penetrate a fuel tank. The BattleJacket technology has been successfully tested in combat and is now being expanded to coat smaller fuel tanks for vehicles, as they are increasingly being targeted. The current application process is hand-spraying which is costly and introduces inconsistencies. The need for large numbers of coated fuel tanks in both Iraq and Afghanistan has created the need to develop a more cost effective automated spray process which utilizes a robot to consistently spray the critical individual layers. The objective of this project is to develop the existing manual spraying process into a fully automated spray process and a mobile facility which contains a programmable robot that can provide for project versatility. A robot mounted on a linear rail will integrate most tasks currently performed by a human, and will result in faster and more reproducible coatings.

Payoff

Development of an automated spray process will enable consistent application of the BattleJacket™ coating layers to various shapes and sizes of fuel tanks. The automated process will improve efficiency / reduce cost; improve consistency of coating; expedite transfer of technology into theater; improve fuel tank safety; improve fuel tank efficiency as a result of less fuel wasted due to projectile caused leakage; and improve environmental safety resulting from decreased fuel leakage.

Implementation

Baseline data for the current manual spray application process will be compared to test trial data using the planned automated spray system to measure quantitative improvements. Specific milestones will include completion of the application control software, integration and trial testing of the control software with the robotic spray application components, and a demonstration of the completed system. Upon successful and timely completion of the Ballistic Protection for Gasoline Tanker Trucks ManTech project and the successful acceptance of the technology by the acquisition Program Office (PO) / Program Executive Officer (PEO) and the relevant Navy Technical Codes, the results will be transitioned to automated application of self-healing and self-sealing protective coatings to fuel tanker trucks as well as other fuel storage vessels. Implementation of such an automated process should be realized as early as the fourth quarter of FY 2009.

Improved Ceramic / Composite Armor Design Reduces Manufacturing Costs

J2258 — Improved Manufacturing of High Performance Integrated Ceramic / Composite Armor

Objective

Ceramic armor systems have been used effectively in personnel and combat vehicle protection systems due to their weight-efficiency and enhanced performance compared to traditional monolithic armor. In current ceramic / composite armor systems, a flat ceramic face plate is manufactured and secondarily bonded to a fiber reinforced composite backing plate. Multiple layers are required to provide multifunctional performance. While proven effective against a variety of bullet and fragmentation threats, current ceramic / composite armor systems are expensive and time consuming to fabricate and difficult to repair. Improved methods for integrating the ceramic / composite armor design, reducing manufacturing costs, and improving throughput are needed.

The objective of this project is to define, develop, manufacture and demonstrate performance of integrated ceramic / composite armor material systems for reduced cost and improved performance. The use of lower cost, near-net shape armor ceramics with tailored woven composite preforms and single step resin infusion processes is expected to result in a more efficient process for integrating the ceramic and composite functional components.

Payoff

Integration of emerging ceramic material technologies with textile-based, integral composite manufacturing processes and lower cost resin infusion processes provides a significant opportunity for improving the performance and manufacturing efficiency of future armor solutions. The use of this manufacturing process is expected to result in improved throughput and a 20%-30% cost reduction with the potential for efficient repair of damaged systems. An additional benefit is a 20-25% reduction in weight for ceramic / composite armor systems with equivalent / improved ballistic efficiency. The overall benefit is lighter weight vehicles with higher fuel efficiency, higher payload, increased speed, increased acceleration, etc.

Implementation

Upon successful and timely completion of this ManTech project and acceptance of the technology by the Program Office and Navy Technical Codes, the results and findings will be transitioned to U.S. Navy, Marine Corps, and Army ground vehicle programs seeking lower cost high performance armors.

Key implementation milestones for the project are as follows:
1. Select candidate ceramic and textile composite material systems;
2. Initial integrated ceramic/composite armor design geometry selected;
3. Initiate ceramic and textile manufacturing process trials;
4. Initial data summary;
5. Establish process for integrated ceramic/composite manufacturing;
6. Final ballistic performance testing data summary; and
7. Final report issued.

PERIOD OF PERFORMANCE:

February 2009 to December 2009

PLATFORM:

DOD ManTech

AFFORDABILITY FOCUS AREA:

Materials / Process Improvements - Composites

CENTER OF EXCELLENCE:

CMTC

POINT OF CONTACT:

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STAKEHOLDER:

JDMTP
Naval Surface Warfare Center

TOTAL MANTECH INVESTMENT:

$702,000

Welding Procedures Developed to Address Plate Temperatures

J2259 — Retrofit of Valve Regulated Lead Acid Battery System

Objective

There are a number of areas onboard the various ship systems where weld repairs are required, but the plate temperature must be limited due to paint, insulation or other materials on or in close proximity to the backside of the component. One example is the retrofitting of valve regulated lead acid (VRLA) battery systems performed at Puget Sound Naval Shipyard (PSNSY), where the backside temperature must not exceed 400°F. The Navy Joining Center (NJC) worked with PSNSY to determine peak backside temperatures for pulsed gas metal arc welds (GMAW-P) made in the flat and vertical-up positions. PSNSY will use the data generated, along with the regression analyses and finite element models that were developed, to predict the underside temperature for a variety of applications. This project addressed the development of thermal profiles that allowed prediction of the amount of time a component could be exposed to elevated temperatures.

Payoff

The goal of this project was to develop welding procedures that would not result in backside plate temperatures in excess of 400°F. By characterizing the change in backside plate temperatures for a range of plate thicknesses and weld heat inputs, it is possible to predict the maximum underside temperatures for a broad range of applications. The regression equations and finite element analyses developed under this project provide PSNSY with an effective tool for making accurate predictions for a wide variety of repair applications. Preliminary estimates based on an initial comparison using different repair procedures on two VRLA installations at PSNSY, indicate that the savings for the 16 remaining installations would be approximately $820K.

Implementation

The data developed under this project is already being used by PSNSY to address a variety of welding applications. Regression equations and finite element models have been supplied to PSNSY for use in predicting backside plate temperatures in order to determine optimal welding parameters, not just for retrofitting of VRLA battery systems, but also for a number of applications in which the backside plate temperature must be limited.

PERIOD OF PERFORMANCE:

October 2008 to June 2009

PLATFORM:

DOD ManTech

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

NJC

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Mr. Lawrence E. Brown
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lbrown@ewi.org

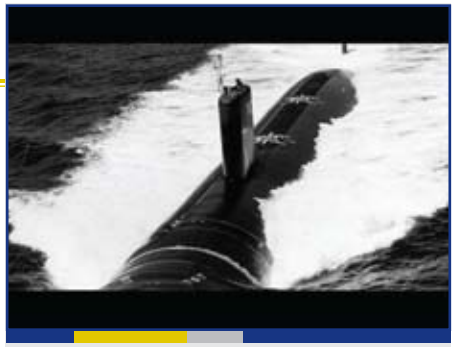
STAKEHOLDER:

JDMTP

TOTAL MANTECH INVESTMENT:

$140,000

Weld Cladding Procedure Extends Service Life of Submarine Components



J2260 — Vibration Reducer Cell Ring Weld Repair Procedure Development

Objective

On certain submarines, there are vibration reducer piston/cell ring sets parallel to the main drive shaft, which absorb propulsion shaft thrust and dampen axial vibration. During normal service, the piston's outside diameter and cell ring's inside diameter develop wear scars caused by dynamic adhesive wear. Eventually, this will reduce the ability of the vibration reducer to function properly and some vibration reducers have seized during service, preventing the main shaft from spinning smoothly or quietly. Every 10 years these damaged piston/cell rings sets are removed and new sets are installed. The objectives of this project were to develop weld repair, inspection and machining methods to bring damaged vibration reducer cell rings back to their original performance specifications, and to implement the developed weld repair technology at the Trident Retrofit Facility (TRF) at Kings Bay Naval Submarine Base. Gas tungsten arc welding (GTAW) was evaluated and validated during this study. Preferred welding parameters passed all NAVSEA Technical Publication S9074-AQ-GIB-010/248 testing requirements for procedure qualification.

Payoff

Implementation of the welding repair procedure developed in this project has the potential to save the Navy $171.4K for each Ohio-class Trident submarine, and $234K for each Los Angeles-Class submarine. The savings obtained would be realized during each main shaft thrust bearing and thrust journal bearing overhaul. Overall potential savings to the Navy would be approximately $15M for the existing fleet of Ohio-Class Trident and Los Angeles Class submarines.

Implementation

The project determined that automated GTAW can be accomplished for cladding of a hardface material to the ID of the cell rings for improved wear performance. All project results and process procedures have been submitted to Kings Bay TRF. It is recommended that Kings Bay TRF evaluate the results of this project to determine if the developed repair method is suitable for production use at their facility.

PERIOD OF PERFORMANCE:

October 2008 to June 2009

PLATFORM:

DOD ManTech

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

NJC

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lbrown@ewi.org

STAKEHOLDER:

JDMTP

TOTAL MANTECH INVESTMENT:

$1,331,000

Ultrasonic Joining Techniques Have Potential Savings of $600K Per Year

J2273 — Ultrasonic Joining of Aircraft Tubing

PERIOD OF PERFORMANCE:

January 2009 to October 2009

PLATFORM:

DOD ManTech

AFFORDABILITY FOCUS AREA:

Not Applicable

CENTER OF EXCELLENCE:

NJC

POINT OF CONTACT:

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lbrown@ewi.org

STAKEHOLDER:

JDMTP

TOTAL MANTECH INVESTMENT:

$700,000

Objective

Aircraft systems are interlaced with metallic tubing for fuel, oxygen, and hydraulics. These are essential to the safe performance of all current and future aircraft and propulsion systems. Tube fittings for these systems are attached by mechanical swaging, brazing, gas tungsten arc welding, CryofittingTM, and flaring. Each method has limitations which cause low first-time yields, and high labor content for set-up, inspection, and rework. The objective of this project is to demonstrate and qualify ultrasonic soldering and brazing for various materials and different classes of applications. Ultrasonic soldering and brazing use some of the same principles as ultrasonic cleaning. A high-frequency vibration is introduced into the liquid solder. This vibration energy induces cavitation in the solder and, consequently, a strong erosion effect on any solid surface in proximity to the cavitation. This cavitation breaks up and disperses any base metal surface oxide and allows the molten solder to wet and bond to the now nascent metal surface. The same principles apply to ultrasonic brazing, although the process occurs at a higher temperature (>450°C). This project will establish tube-to-end fitting soldering to MRL 7 and advance ultrasonic brazing to MRL 5 processes. The joining process will be demonstrated to the original equipment manufacturer (OEM) partners.

Payoff

These challenges affect quality and cost, downgrades hardware yield, and compromises system readiness in the field. The technology developed in this project will have a significant, pervasive effect, as it can be applied to aircraft, engine systems, weapons systems, and space systems. The direct projected savings are expected to exceed $600K per year on the specific applications planned, independent of cost savings and other benefits from the elimination of schedule disruptions and system rework. Once demonstrated, broader cost reductions and schedule impacts are realistic as the joining technology can be readily transitioned over to other systems, sustainment, and modernization of new systems.

Implementation

Having three parallel aircraft OEM's involved (Boeing, General Electric and Rolls Royce), the transition of this technology may occur in the near term, and continue over a sustained period of time in the future. Near-term implementation would occur on parts targeted in this program within the next few years. However, successful implementation in a few key areas could lead to an industry wide change in joining tubes and fittings. Such a pervasive change will likely take significantly longer.

by Project Title

by Project Number

by Project Number

by COE